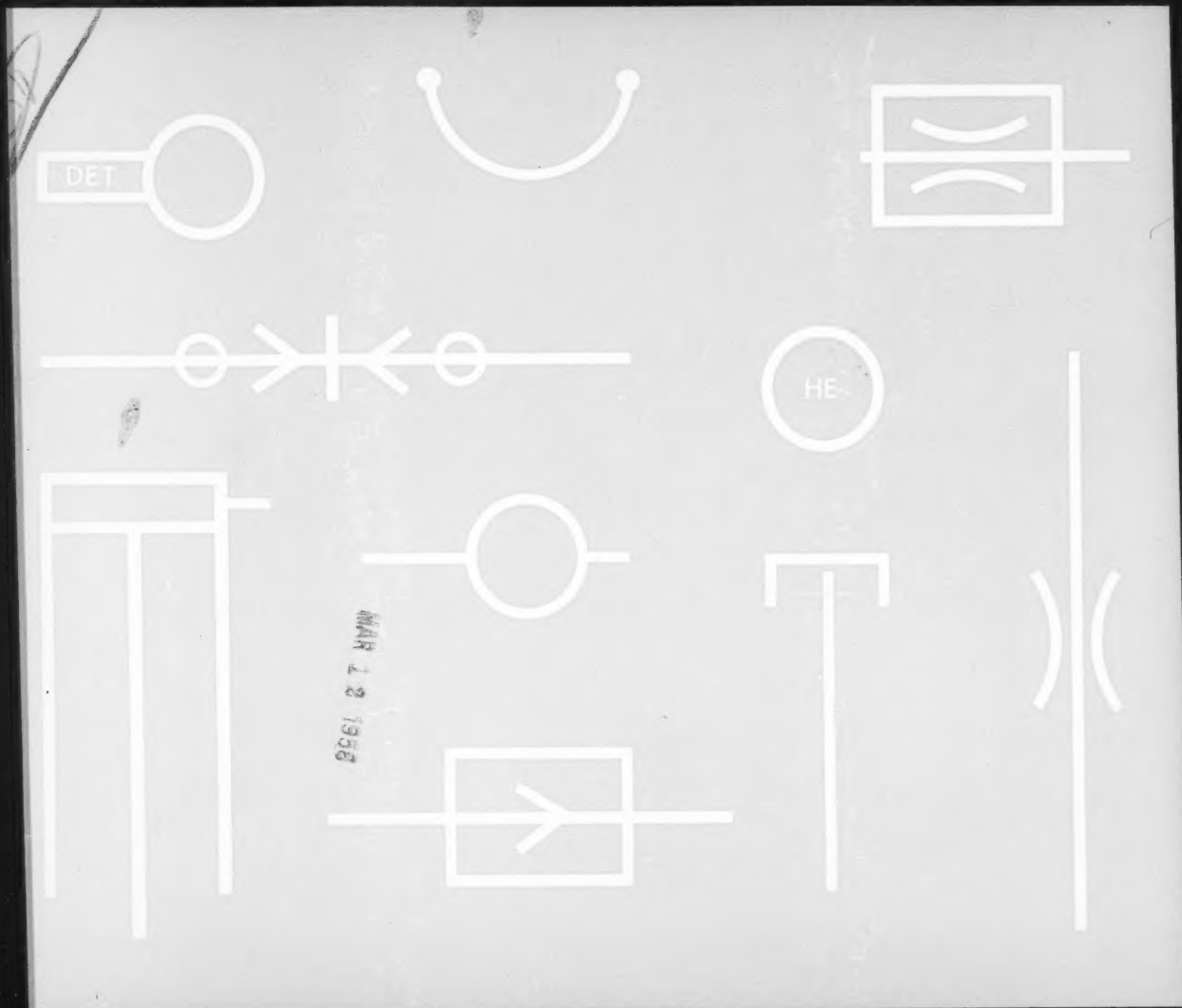


# Design Engineering

FIVE DOLLARS A YEAR



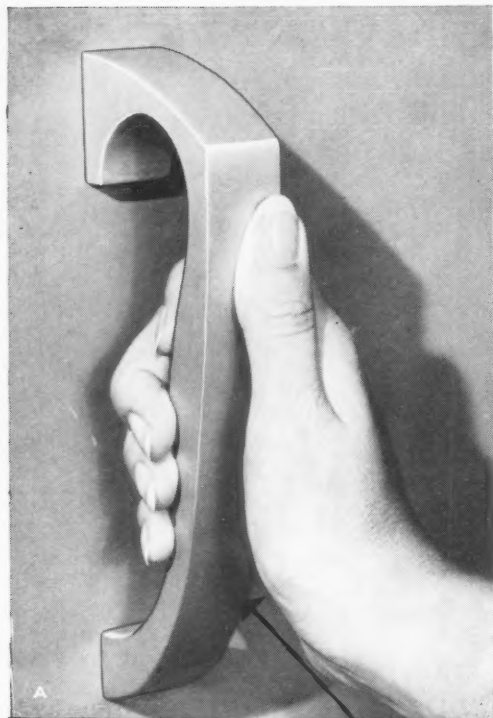
## Hydraulic accumulators

## Seals for engines

## Fluid power diagrams

## March 1958

# Open the door to new freedom in design with ALCAN ALUMINUM EXTRUSIONS

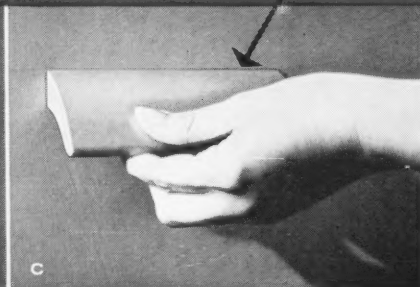
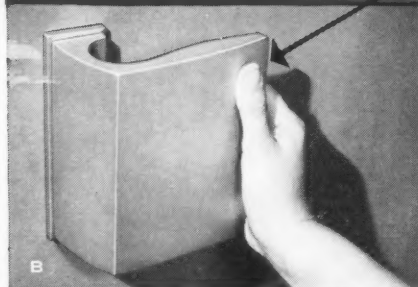
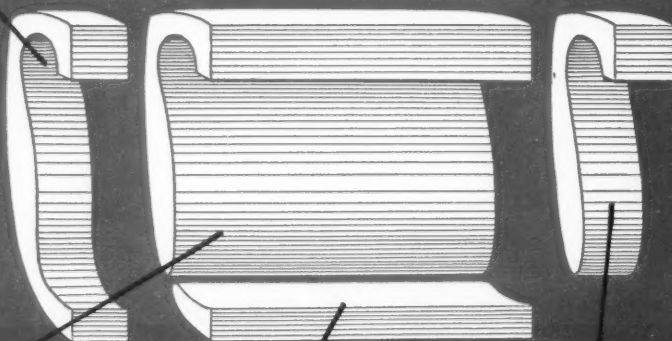


Offering a limitless variety of shapes and sizes, Alcan Aluminum Extrusions can help you improve your products and reduce costs.

Alcan aluminum extrusions have the uniformity and close tolerances that reduce assembly machining time. Labour, material and assembly costs are further cut because one-piece extrusions eliminate costly joining operations.

Alcan aluminum extrusions find a hundred and one applications in furniture, household appliances, machinery, motors, toys, and end products of all kinds. For full information on standard or special shapes to meet your requirements, call your Alcan Sales Office.

Here's a practical example\* of the versatility of aluminum extrusions. 'A' - the basic one-piece extrusion cut to width for an attractive door pull. 'B' - the same extrusion modified and used in another width. 'C' - a section put to use as a drawer pull. 'D' - the modified version (B) cut to a thinner width for a lever handle.



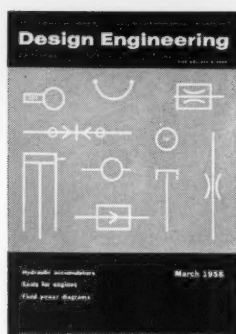
\*Developed for Raymond Manufacturing Company by Alcan.

**ALCAN**

**ALUMINUM COMPANY OF CANADA, LTD.**

CALGARY HALIFAX HAMILTON MONTREAL OTTAWA  
QUEBEC TORONTO VANCOUVER WINDSOR WINNIPEG





# Design Engineering

VOL. 4

MARCH 1958

No. 3

## This month's cover

The mystical hieroglyphics in the sand of the cover were traced by the finger of cover artist Sam Smart (see DE for February, page 3). They'll be no mystery to any engineer up on his hydraulics as they are symbols from the proposed standard for fluid power diagrams. A feature article on this subject will be found within the issue.

## Design Engineering

MEMBER



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## THE ROOT OF THE MATTER

Orenda is pioneering many new concepts in jet engine design.

The IROQUOIS supersonic turbojet, now producing over 20,000 lbs. (dry) thrust in its early development, incorporates several. The outstanding performance of the IROQUOIS, combined with inherent low weight, is the reason it has been selected for the Avro Arrow, Canada's new supersonic interceptor.

Illustration shows stress patterns in a jet engine blade root under load, using color photography and photo-elastic stress analysis.



MEMBER: A.V.ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

## Design Engineering

## Inside

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**W. E. Jones** (Sealing with present day methods) is chief development engineer for Orenda Engines Ltd., where he directs testing programs which prove experimental jet engines under actual flight conditions or accumulate technical data to improve engines in production. Before joining Orenda, Mr. Jones was director and chief engineer of Lucas-Rotax Ltd.

Before coming to Canada in 1949 he participated in some of the earliest air testing of jet engines in England.



**Robert C. Sasena** (Brushing parts that have no centre support) is a project engineer in the brush division of the Osborn Mfg. Co. of Cleveland. He has been with them for sixteen years. He attended Fenn College, graduating with a B.S. in chemical engineering.

During World War II he served as a lieutenant in the USN and saw action in the Pacific. He is a member of the Electroplaters Society and very active in the local Boy Scout Council. When his four children will allow him, he enjoys fishing, stamp collecting, photography and Hi-Fi.

**Herbert H. Schmiel** (Methods for storing hydraulic energy) is chief engineer, Parker Hydraulics Division, Parker-Hannifin Corp. He is a native Cleveland.

Starting in 1935 as a draftsman with Cleveland Tractor Co., he joined the Hydreco Division of New York Air Brake Co. in 1940 and later became assistant chief engineer. In 1955 he joined Parker to head up engineering on hydraulic components for mobile equipment. He is a member of the Society for Automotive Engineers, is married, with one daughter.



Open the door to a completely new concept

## in Power Transmission with **POWERGRIP** Timing Belts

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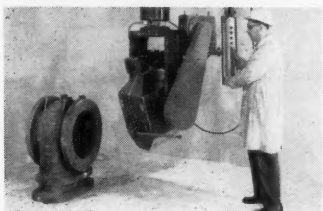
**Dominion Rubber**  
Mechanical Goods Division



# Reports

**A news roundup of items of engineering and design interest from the world over**

## **Cobalt camera in a concrete-walled pit**



Dofasco's new cobalt camera is 100 times as powerful as the unit which it replaces and has a rating of 755 curies. It employs radioactive cobalt 60 as its source of power and is used in the radiographic inspection of steel castings. Its high power source enables the machine to probe through solid steel in its search for hidden flaws.

The device is located in a 3-ft. thick concrete-walled pit, 14 ft. below ground level. Above ground the area is walled and fenced off to prevent entry of unauthorized personnel. Entrance to the room is gained by passing through a concrete maze and an interlocked door.

## **Sub-hunter crews to learn on a flight trainer**



Training for RCAF crews of the CL-28 Argus submarine hunter will come via an operational flight trainer built for them by Canadian Aviation Electronics.

CAE's trainer (they did one for the RCAF's CF-100 all-weather interceptor) will familiarize the Argus crew while on the ground with the operation and characteristics of the engines and aircraft in flight.

## **This way, you join it if you spin it**

"Spin-Welding" is the name given to a simple fabricating technique used to join thermoplastic materials without an adhesive or other bonding agent.

In this process, the heat generated by spinning two surfaces against each other causes enough melting to bond the parent materials, and can be accomplished on a lathe, drill press, or other suitable device.

## **Stud welding products directly available**

Nelson stud welding products (see Design Engineering for November, 1957) are now being distributed on a direct-to-user basis by Nelson Stud Welding Corp. (Canada) Ltd. Man in charge of the manufacturing and sales operations for the company throughout Canada is Herbert Scott, who has been with them for eight years.

## **New muscles for a west coast logging tug**



This trim 36-ft. craft is the Cowichan Yarder which earns its bread towing logs around in B.C. Recently repowered with a GM diesel, it now has an engine with a rating of 220 shaft hp continuous and 300 maximum hp.

The diesel, which turns over at 1,800 rpm, is fitted with a 3.75:1 ratio hydraulic operated GM Allison reverse reduction gear turning a 52-in.-by-25-in.-pitch propeller at 480 rpm.

The vessel has a 32-volt starting system with a 1,500-watt generator. It is equipped with a keel cooler and a dry-type, 5-in. Maxim exhaust silencer.

## **Documents and photos travel by telephone**



The automatic transmission of practically any type of document is possible with a new facsimile instrument (Mufax) now being marketed. The document is loaded on the transmitter drum and the pointer control is then set to correspond with the end of the document. When a start button is pressed the machine operates entirely automatically. A feature of the equipment is the fact that it will do its work over ordinary telephone wires. It has a speed of 10 in. of copy every three minutes.

## McGill's summer school for executives



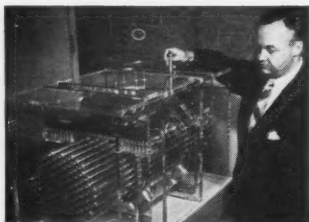
Believing that modern business competition requires executives of higher standard who can accept heavier responsibility than was the case a generation ago, McGill University is scheduling a four-week summer school in executive development from May 26 to June 20.

Students, who will live in Douglas Hall (one of the men's residences) will participate in lectures, seminars and conferences on such subjects as finance, marketing management, business policy and human relations. Additional information from Professor Eric W. Kierans, director of the School of Commerce, McGill University, Montreal.

## Light you may be able to mold to your fancy

Westinghouse has come up with a flexible "light bulb" which can be bent into various shapes. The pliable electric lamp is actually an electroluminescent cell. This makes use of a method by which specially coated sheets of glass, metal or plastic can be made to produce light. A phosphor is coated on a panel which has been treated to conduct electricity. When power is applied, the panel lights. It is expected that, in the future, it will be possible to produce window shades, drapes and other flexible materials that actually get a glow on.

## Canadian natural uranium in the power race

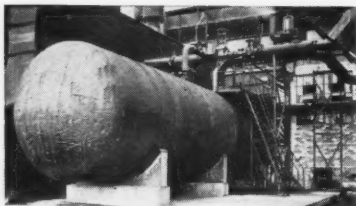


Still with Westinghouse, we have the news that the company has entered the world-wide commercial atomic power race with the completion of the first of several studies to determine the immediate prospects of economically competitive nuclear power.

Picture shows a model of the Westinghouse "HPTR" reactor. The unit has been developed to use Canadian natural uranium by applying heavy water as the moderator. It will produce electrical power under commercial conditions at a low cost of 6.5 to 12 mills per kilowatt hour.

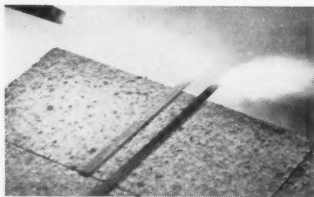
(Design Engineering has an article on the increasing importance of the model as a design tool in this issue.)

## Storing steam for use at a later time



In recent years there has been a considerable increase in the use of steam accumulators in England (and some other European countries) but little attention has been paid to this development in North America so far. With an association announced recently of Dominion Bridge Co. Ltd., and Steam Storage Co. Ltd., the British technique and experience in this specialized field will be available to Canadian industry. Steam accumulators are designed to level out the severe boiler plant load fluctuations encountered in many industrial processes and to ensure a plentiful supply at peak loads.

## Molybdenum: a chance to use its strength



Up till now it has been impossible to take advantage of molybdenum's outstanding high temperature strength because at high temperatures this metal forms a volatile oxide which leads to rapid erosion and eventual deterioration.

As a result of a new surface alloying technique announced by Chromalloy Corp., molybdenum can be utilized at working temperatures in excess of 2000F. This makes it ideal for such applications as gas turbine blades, ram jet flame holders, turbine wheels, nuclear reactor rods and so forth.

## Next month..

In addition to all the regular department features, April's Design Engineering will carry articles on the following subjects:

CO<sub>2</sub> hardening  
Ballizing  
Level gauges  
Cycloidal propulsion  
Stamping design

Stainless steel castings  
Flow developer  
Miniature couplings  
Injection valve  
Rod ends

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## NEW

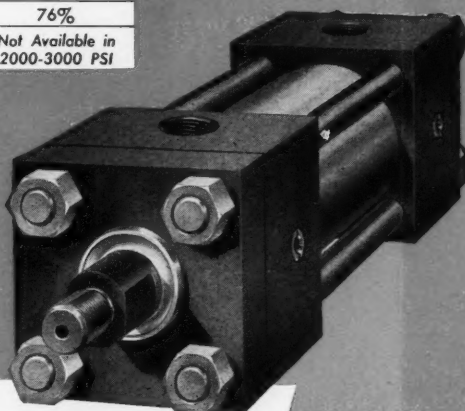


## "JOB RATED"

### HYDRAULIC CYLINDER LINE

with **IDENTICAL** seals, design, and safety factors as the famous Miller "Power-Packed" Model "H" Line for 3000-5000 psi service.

JOB RATED, MODEL "J"			
BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	Not Available in 2000-3000 PSI



## SEAL FAILURE MEANS CYLINDER FAILURE!

1. No seal made of synthetic rubber is compatible with even 50% of available, commercial, petroleum base hydraulic fluids.

**MILLER Uses All Teflon\* Seals to Eliminate External Oil Leakage** because Teflon is impervious to all known hydraulic fluids, even fire-resistant types.

#### TEFLON SHEF SEAL At Tubing Ends

No blind assembly. Is  
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#### TEFLON Seals On Piston Rod And Bushing

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

#### TEFLON Seals On Ball Check And Adjusting Screw

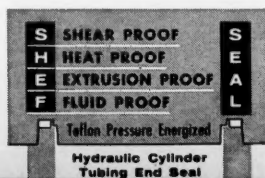
Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

**MILLER Uses Resin-Impregnated Leather Piston Cup Seals** because they are compatible with petroleum base fluids and some fire-resistant types. Teflon cups available at small extra cost.

2. Nicked or scored piston rods cause seal failure

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**NOW!** . . . You can save **MORE** with quality Miller "Job-Rated" Cylinders than with cut-price, lesser quality hydraulic cylinders. And the "Job-Rated" Cylinders are also available under the same immediate shipment program as the Power-Packed Line (2 hours if necessary—3 days normal).

\* du Pont trademark for tetrafluoroethylene resin which withstands temperatures from -100° F. to +500° F. and all hydraulic fluids.


#### OTHER MILLER QUALITY FEATURES

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*Discover new materials.*



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# ENGINEERING SHOW

## *What you'll see:*

- Mechanical components
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- Shapes and forms
- Hydraulic and pneumatic components
- Power transmission equipment
- Research and testing equipment
- Engineering equipment and services

## *Concurrent A.S.M.E. Conference*

Sponsored by the Machine Design Division, American Society of Mechanical Engineers, the 1958 Design Engineering Conference will be the most important event of the year in your field. Speakers and panel members are top authorities in their subjects. Separate sessions on *mechanical*, *electrical* and *materials* problems allow engineers to devote their time to areas of primary interest.

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## 1958

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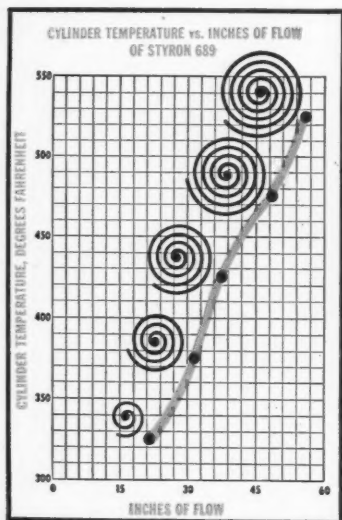
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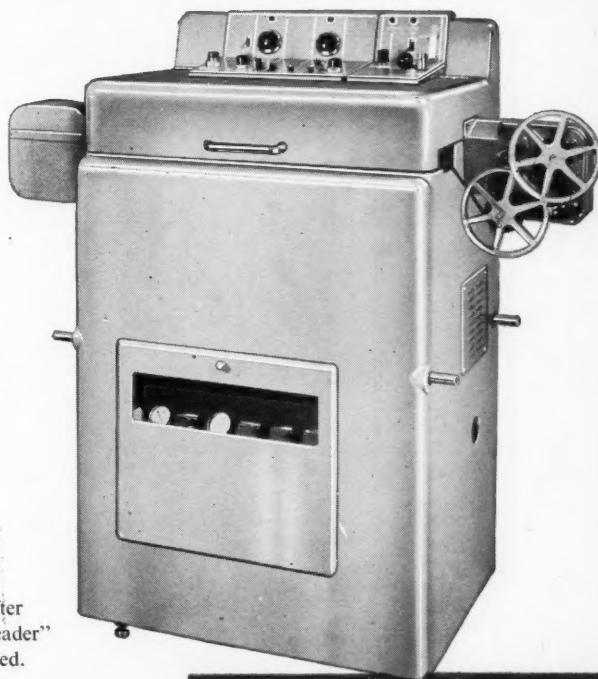


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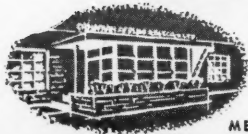
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                           1 or 2 rolls 35 mm } to  
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 Rate of Processing: 1½, 3 or 6 ft. per min.  
 Temperature-controlled solutions and dryer. Daylight operation except loading of film into magazine. Processes perforated or plain film.

## Canadian Applied Research Limited

(formerly PSC Applied Research Limited)

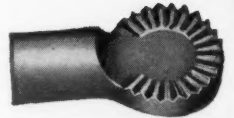


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#### VALVE LINKAGE LEVERS

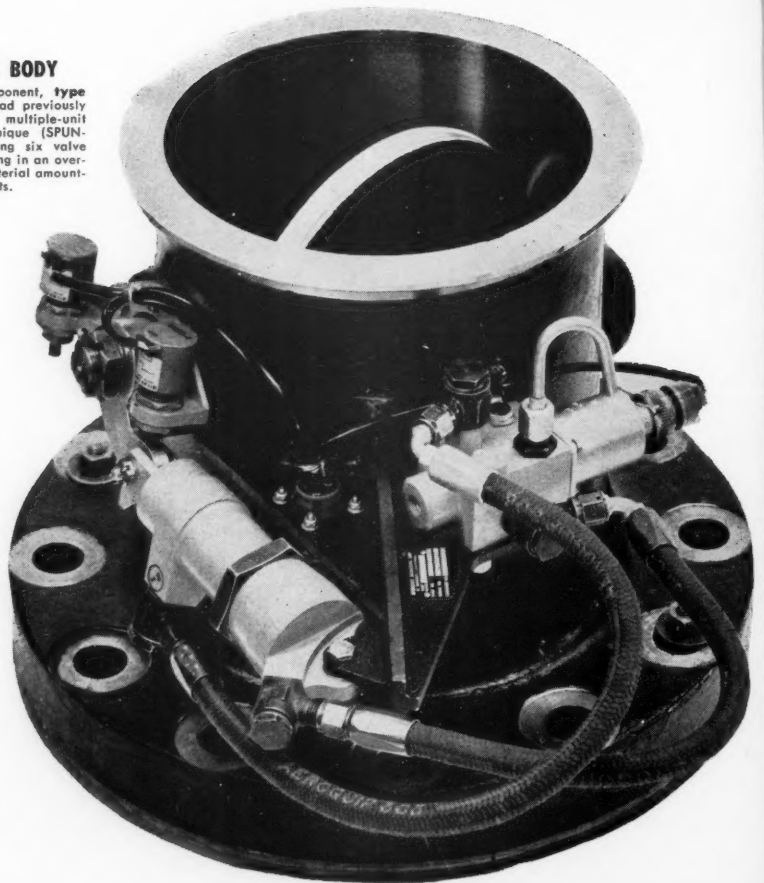
Small parts are no problem. These ESCO SHELLCAST corrosion resistant alloy steel type 317, A296-49T, CF-8M, valve linkage levers weigh less than two ounces each.



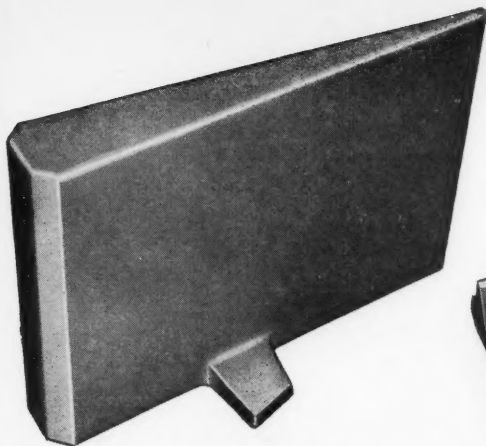
**Before you say,**  
**"It can't be cast,"**

#### BUTTERFLY VALVE BODY

This guided missile component, type 304, A296-49T CF-8, had previously been fabricated. ESCO multiple-unit centrifugal casting technique (SPUN-CAST®) was used, casting six valve bodies at one time resulting in an overall saving in time and material amounting to 30% of former costs.

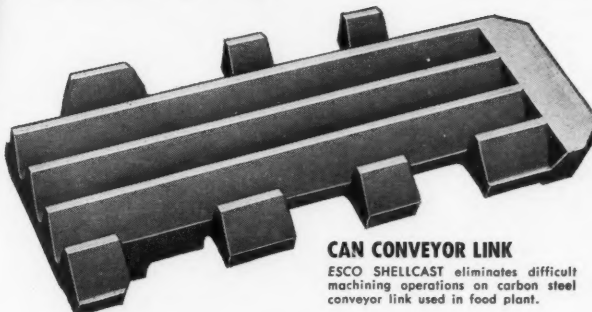






#### HEAT-TREATING VANE TIP

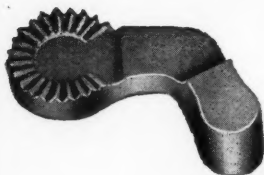
ESCO SHELLCAST in a heat resistant weldable alloy, type 302B, A297-49T HF, eliminated all former machining.



#### CAN CONVEYOR LINK

ESCO SHELLCAST eliminates difficult machining operations on carbon steel conveyor link used in food plant.

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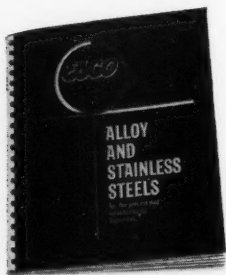
A casting service that covers the complete range of alloy steel casting methods for all applications . . . **PLUS**

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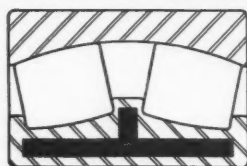
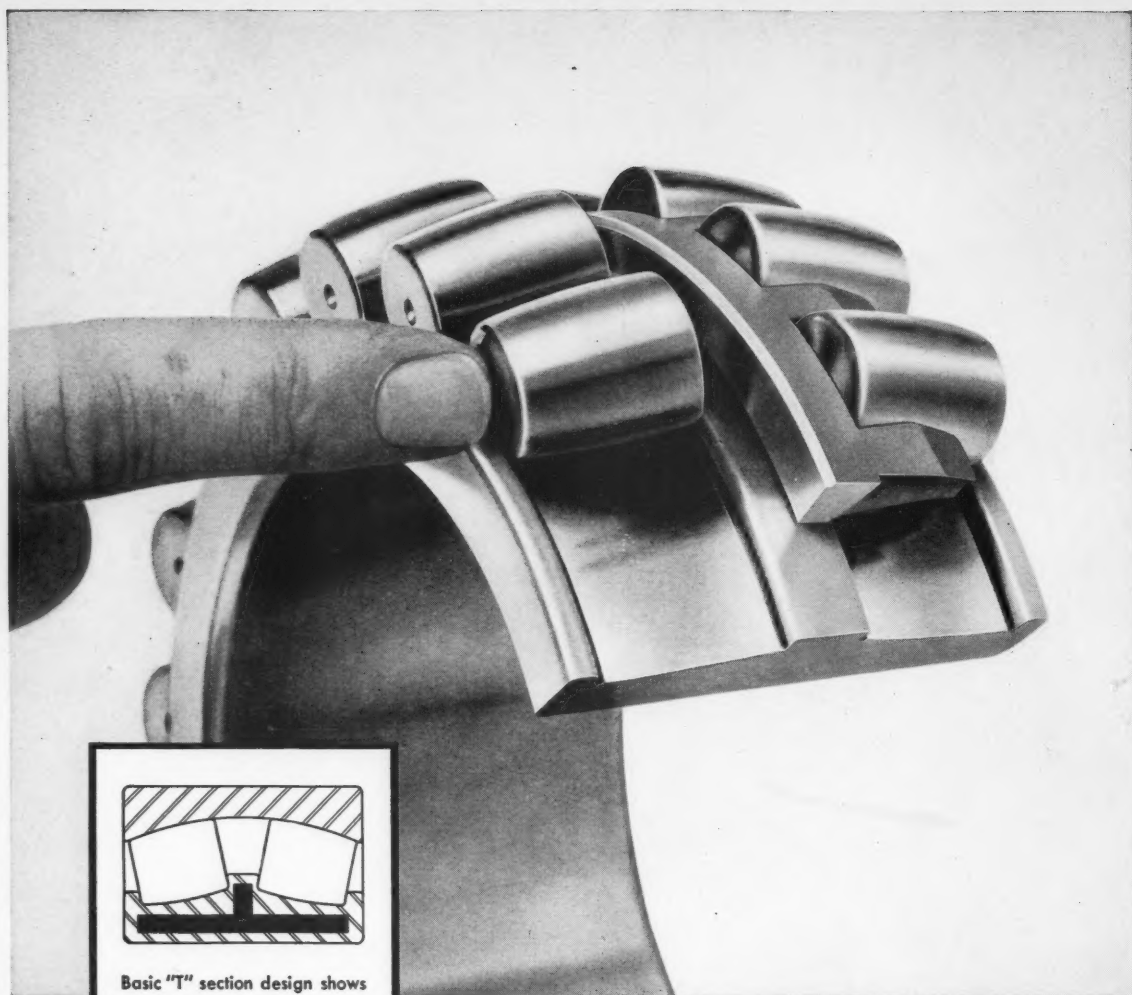
ESCO laboratory technicians are qualified and equipped to perform all types of inspections and testing to the most rigid specifications.

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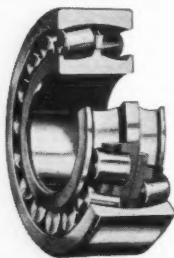
Write today for your FREE copy of this informative 100-page reference book—"ESCO Alloy and Stainless Steels for the Process and Manufacturing Industries".



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The only *positive* way to guide rollers is by an integral center guide flange—backbone of the Torrington Spherical Roller Bearing. No floating ring can match it for stability under heavy radial and thrust loads.

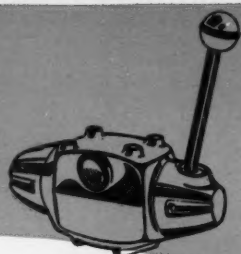
This "bearing with the backbone" insures true rolling motion . . . prevents stress concentration . . . means minimum friction. It makes possible open-end cage design, too, with no shrouds to impede circulation of lubricant to bearing contact surfaces. There is less heating and more positive lubrication.

The integral center guide flange is adapted from the same principle used in the design of Torrington Tapered Roller Bearings. This refinement is typical of Torrington's uncompromising engineering that assures you the ultimate in bearing performance. The Torrington Company Limited, 925 Millwood Road, Toronto 17, Ont.

## **TORRINGTON BEARINGS**

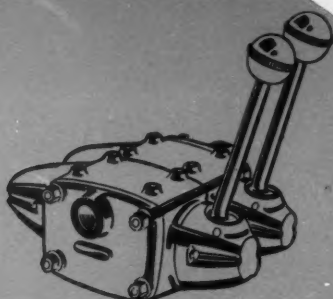
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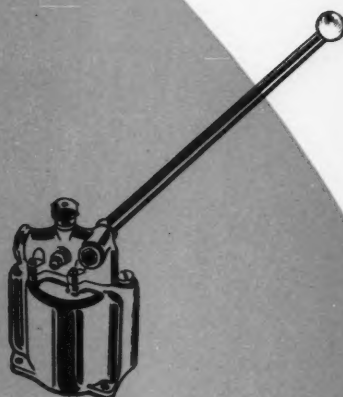
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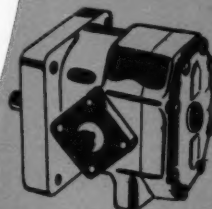
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**IP 1503**

45° Elbows for O.D. tube sizes from 1/4" to 1"

Split Flange Ends—"O" Ring Shoulder

**UIP 1509**

90° Elbows for O.D. tube sizes from 1/4" to 2".

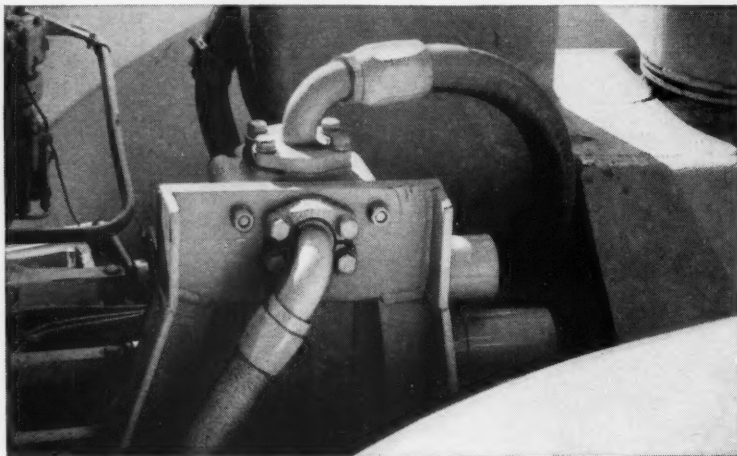
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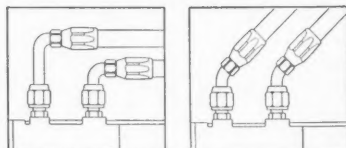


Split flange elbow fittings connecting medium and high pressure hydraulic lines on construction equipment.

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and permit compact hose bends and contours without placing stress on the hose itself.

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Toronto 19, Ontario

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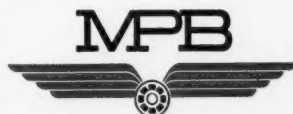
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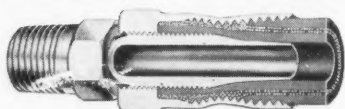
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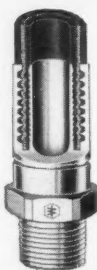
### Bulk Hose



### Hose Assemblies



**Crimped**



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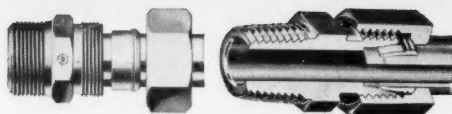


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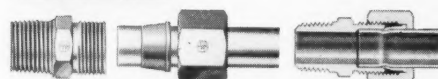
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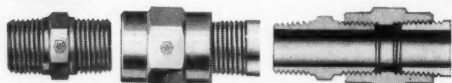
### COMPRESSION



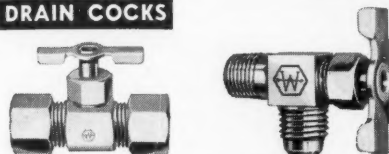
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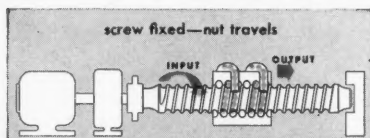
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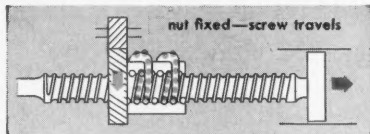
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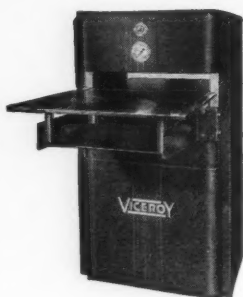
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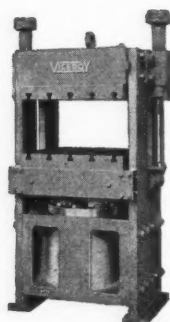


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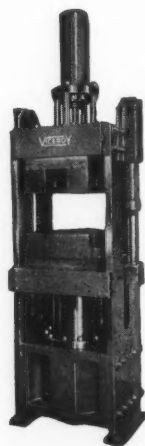
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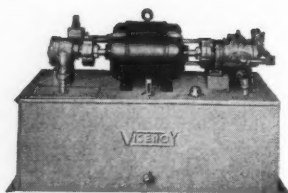
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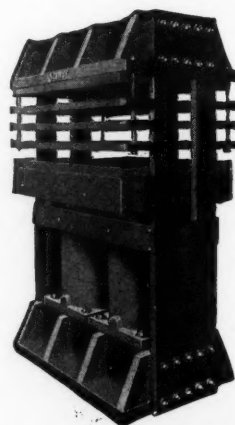
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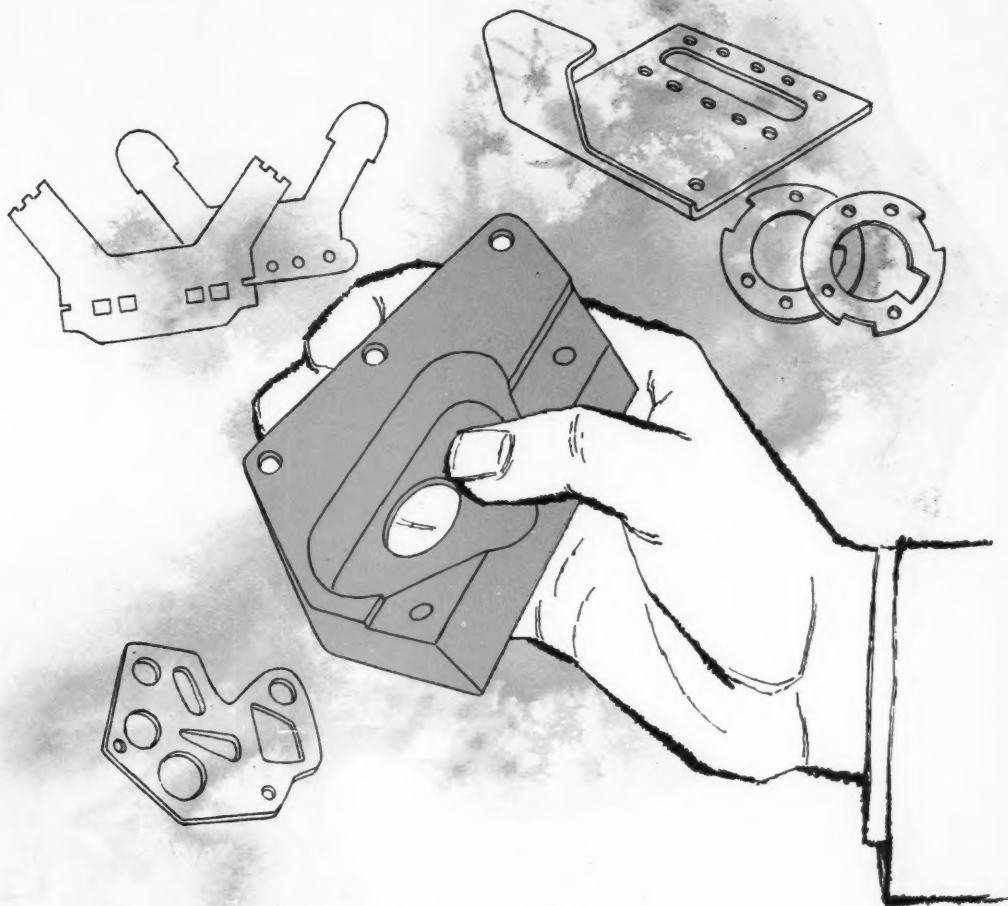
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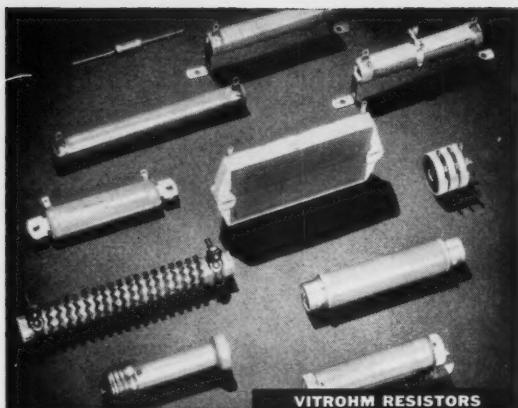
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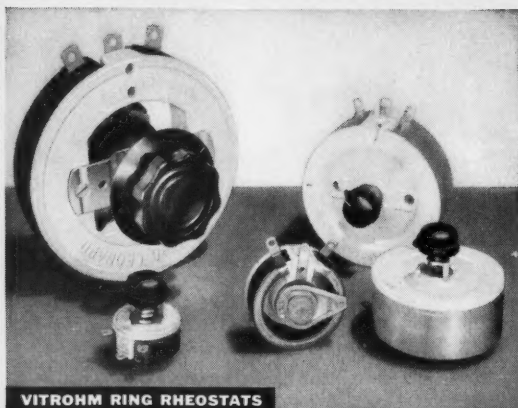
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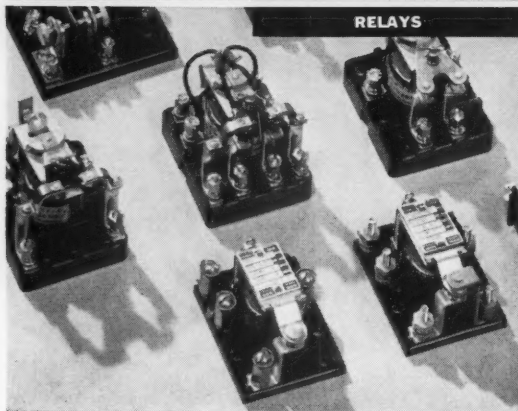
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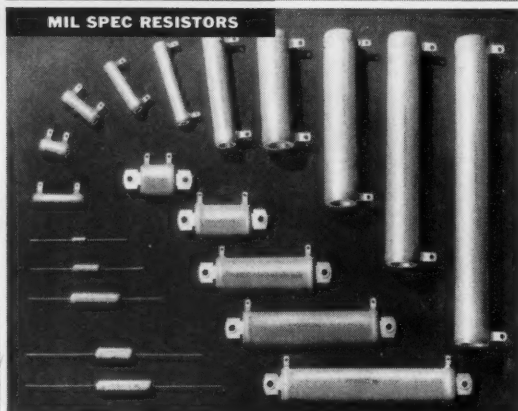
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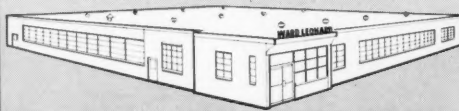


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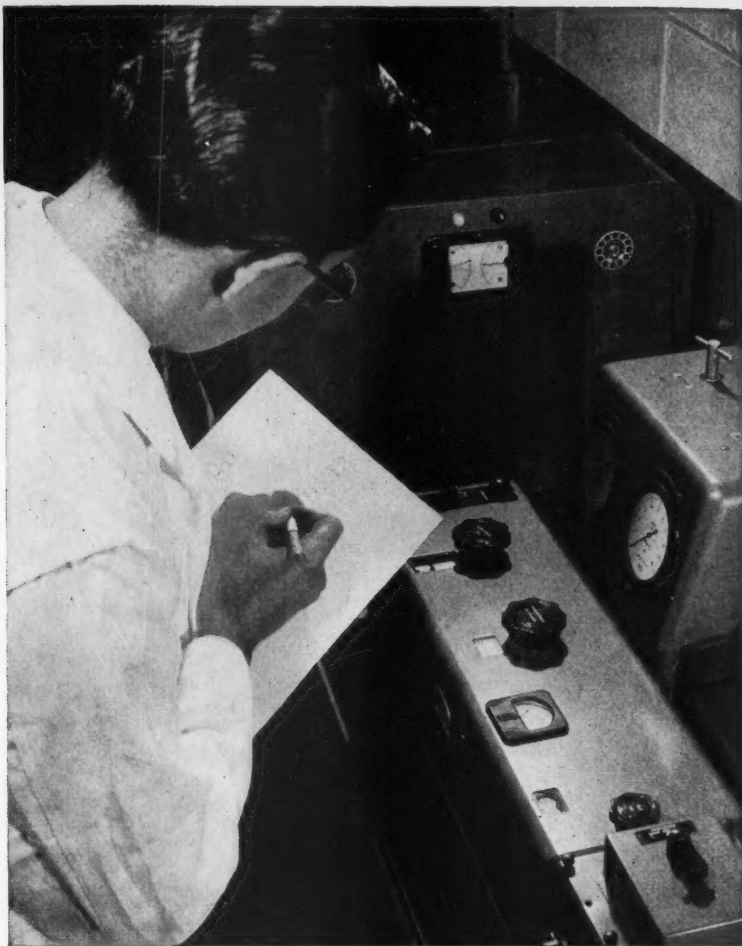
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Our Technical Service Department is also equipped to give you assistance in developing improved methods for *applying* your finishes. This service is yours for the asking—if necessary in your own plant or in the field.

Whatever your problems, whatever your needs, Glidden is prepared to assist you in meeting them. Please contact our service representative or write to us direct.

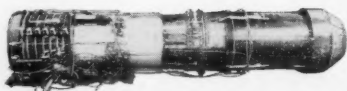
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Variable stators are used for the first time in a flying jet engine, which in a mechanically simplified way, and with far less weight, accomplish the same thing that the dual rotor does in other current engines. The device provides a smooth flow of air inside the engine and eliminates the "stall barrier" problem.



**HEIM UNIBAL SPHERICAL BEARINGS and ROD ENDS** supply the exact type of linkage, mounting, and degree of misalignment correction required by this engine, and The Heim Company is proud of its contribution to the success of the GE J79.

There are over 200 Unibal Rod Ends assembled with the variable pitch stator blade operating levers.

There are over 50 LS type Unibal Spherical Bearings used as pivot points for the inlet guide vanes.

The bearings which mount the engine to the airframe are three Heim Unibal cartridge units. These bearings carry the entire weight of the engine *and its thrust*.

Other Heim bearings of various types used on this engine bring the total to around 500.

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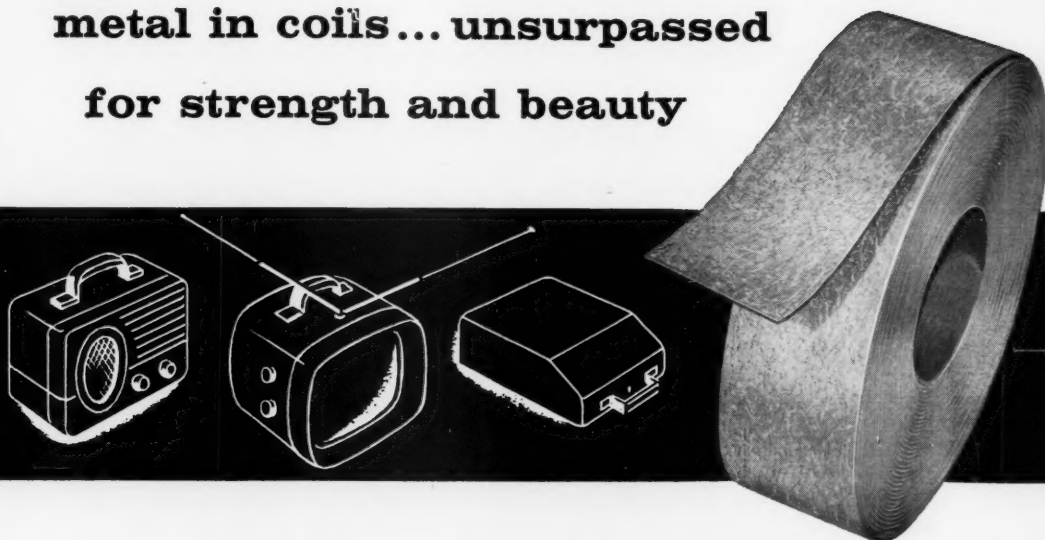
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# New trends and developments in designing electrical products . . .

General Electric thermistors and Thyrite\* varistors have unique properties that apparently contradict normal electrical laws. Here's how they can be harnessed to improve your product.

General Electric thermistors and Thyrite varistors are ceramic-like semiconductor resistance materials. Each has unique properties — apparently disobedient to normal physical laws — that enable it to perform tasks in electrical and electronic circuits which otherwise would require costly, complex components.

The distinguishing feature of thermistors is their *thermal sensitivity*. Thermistors have large *negative* temperature coefficients of resistance (i.e., their resistance decreases tremendously when heated, instead of increasing slightly like other materials).

Thyrite varistors, on the other hand, are *voltage-sensitive*. Contrary to Ohm's law, a current through a Thyrite varistor varies as a *power* of the applied voltage (i.e., doubling the voltage through a Thyrite varistor can increase the current from 15 to 25 times, instead of the normal 2 times).

The applications based on the unique properties of these materials are almost limitless. In general terms, thermistors are used in the detection, measurement, and control of minute energy changes; Thyrite varistors are used to protect, stabilize, and control circuits.

To give a clearer understanding of the ways thermistors and Thyrite varistors can be applied, here's how they have solved two of the electrical engineer's most vexing problems — temperature compensation and surge suppression.

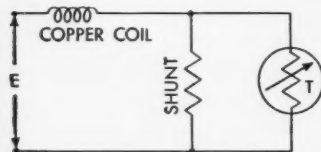


FIGURE 1 — Typical thermistor temperature-compensation circuit

The resistance of a conventional conductor is so affected by ambient temperatures that steady current flow cannot be maintained. For example, as the temperature of copper swings from  $-60^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$ , the resistance increases 53%.

However, when the copper is compensated with a properly selected thermistor, the maximum deviation

from the total average resistance at  $25^{\circ}\text{C}$  is only  $3\frac{1}{2}\%$  — despite the  $140^{\circ}$  swing in temperature.

In the circuit in Fig. 1, the thermistor's negative temperature coefficient of resistance offsets the positive temperature coefficient of the copper to stabilize current flow. In other circuits, thermistors can be utilized for signal and warning devices, sequence switching, and other time delay applications, because of the inherent thermal inertia involved.

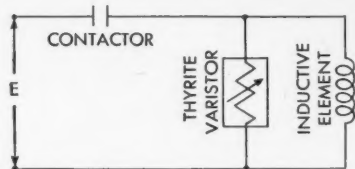


FIGURE 2 — Thyrite varistor surge voltage suppression circuit

Sudden interruptions of inductive circuits cause surge over-voltage, arcing, and high-frequency oscillations — all of which can cause trouble. The circuit in Figure 2 shows how a Thyrite varistor can be connected to hold these effects within safe limits.

With the Thyrite varistor out of the circuit, the surge voltage caused by interruptions of the current may rise to 9 times applied peak voltage (Oscillogram, Figure 3).

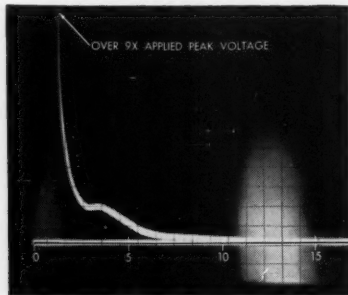


FIGURE 3

But with the Thyrite varistor in the circuit, (Figure 4), the surge voltage is limited to less than 3 times the normal applied peak voltage.

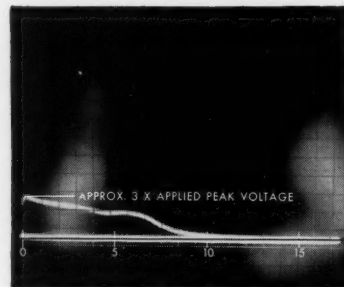


FIGURE 4

The Thyrite varistor draws negligible current at rated voltage, yet offers sufficiently low resistance at the peak current to limit the surge voltage to a safe value and to reduce arcing. Also, the Thyrite varistor quickly discharges circuit energy by providing increasingly higher resistance as the inductive current decays.

If a linear resistor were used to provide the same voltage suppression level, it would have to draw a current equal to more than 30% of the inductive element current.

In addition to surge suppression, a Thyrite varistor can be used as a nonlinear resistance parameter, a potentiometer, and a frequency multiplier. It can also be used as a bypass resistor to protect personnel and equipment from circuit faults.

Technical literature giving complete data on properties, applications, sizes, and shapes of G-E thermistors and Thyrite varistors is available. And, for the experimenter, there are two engineering test kits on each.

To obtain kits or literature, write: Permanent Magnet Sales, Canadian General Electric Co. Ltd., 940 Lansdowne Ave., Toronto 4, Ontario.

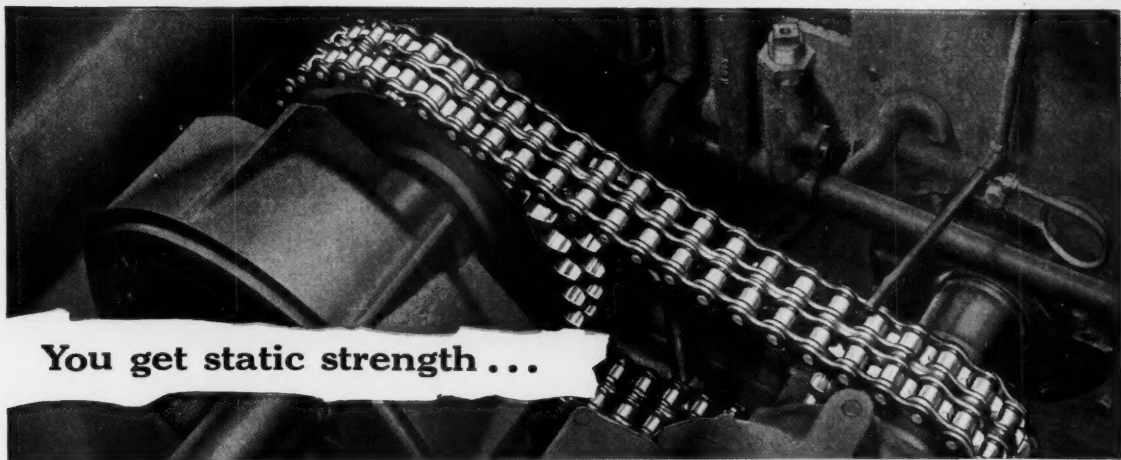
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**CANADIAN GENERAL ELECTRIC  
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DESIGN ENGINEERING MARCH 1958

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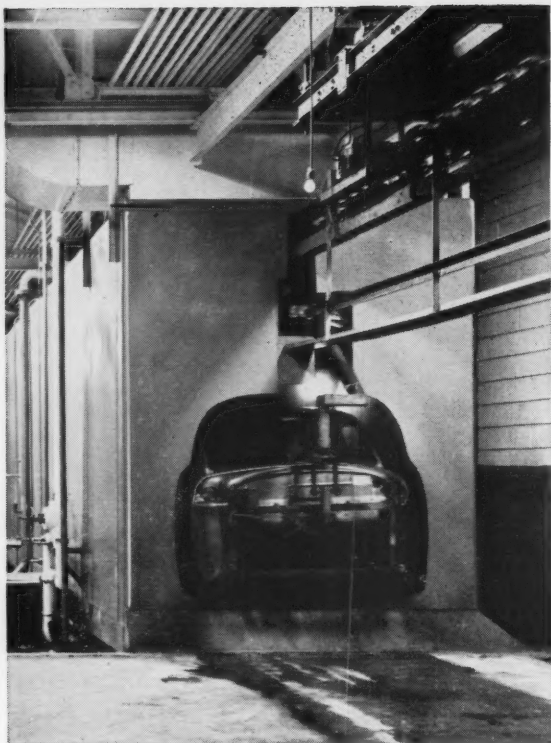
For full data on Link-Belt roller chain, see your Link-Belt office or authorized stock-carrying distributor.



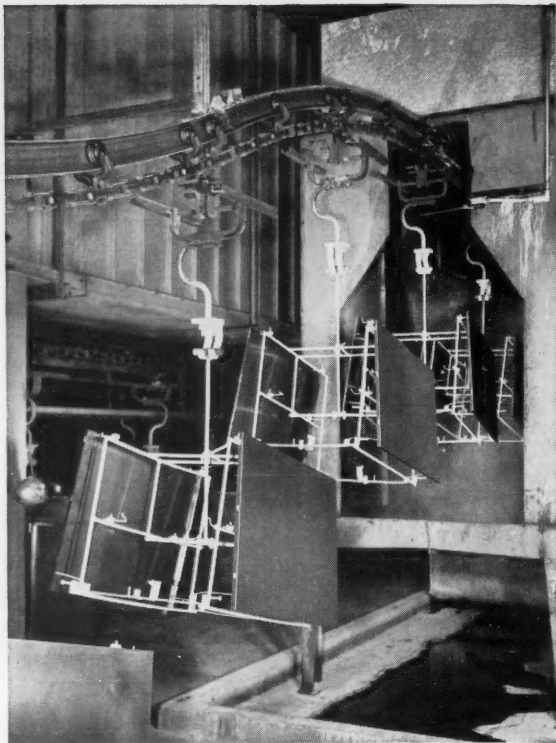
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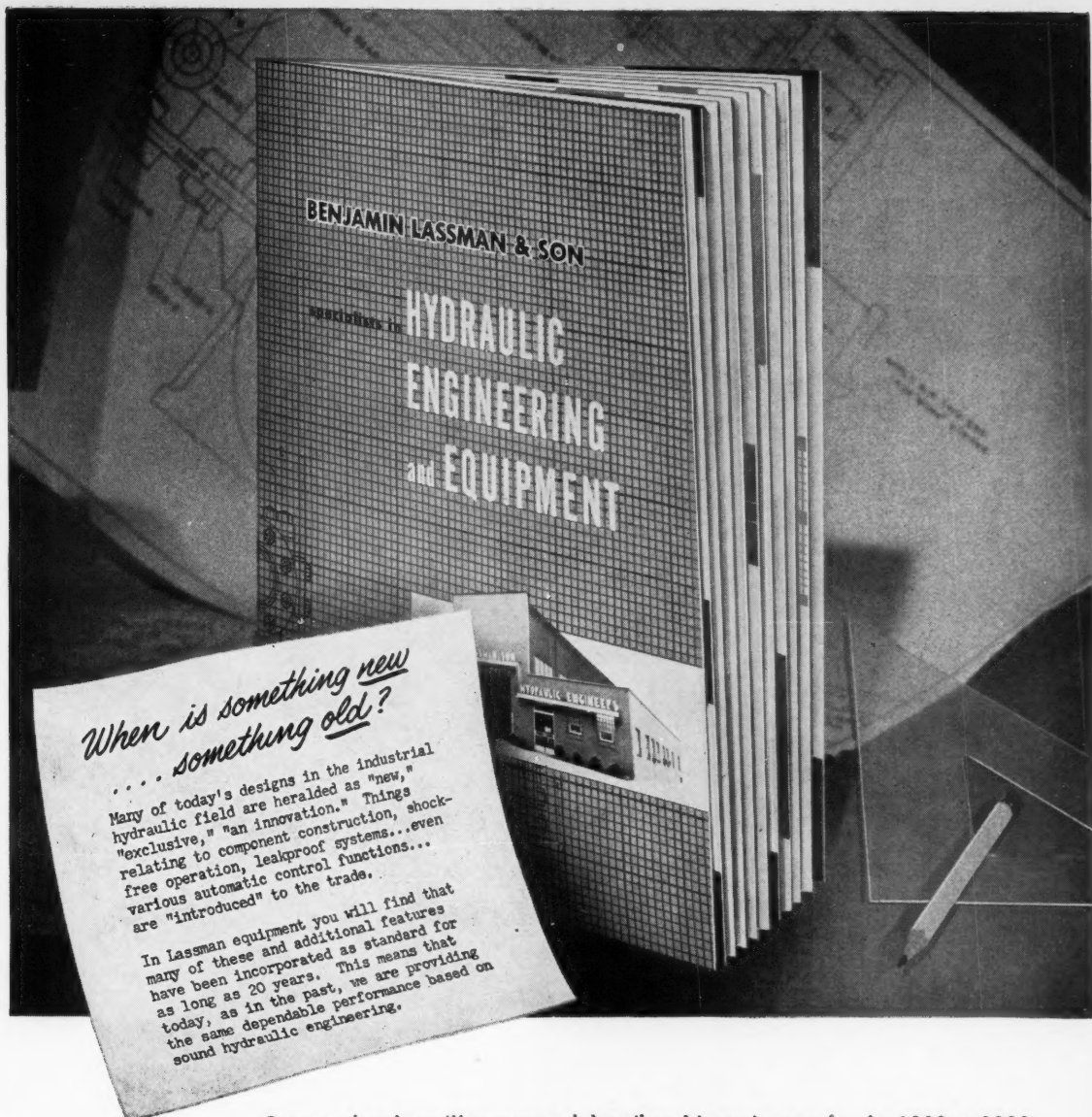
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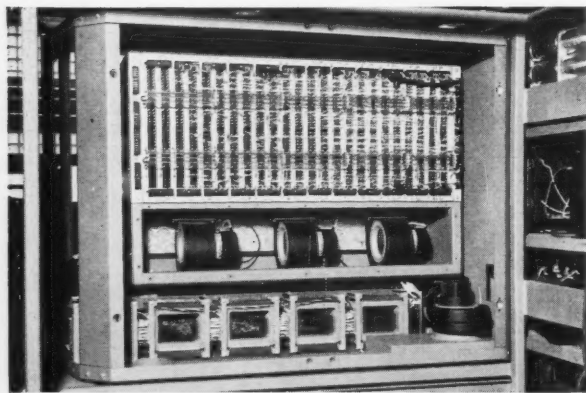
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# THE NATIONAL SCENE

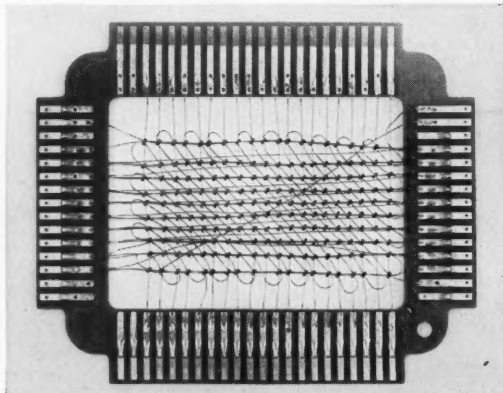


**KEEPING "ELECTRONIC BRAINS" FROM LOSS OF MEMORY.** One of science's greater marvels is IBM's 705 Electronic Data Processing Machine—which makes intricate calculations and logical decisions in millionths of a second. Heart of this electronic "wizard" is its main magnetic core memory. Designed for use with the machine's high-speed printer is the IBM 760 Control and

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**MOST ADVANCED FORM OF ELECTRONIC STORAGE.** The 1,000-position core memory for the IBM 760 Control and Storage Unit—a portion of which is shown here—consists of pinhead size cores strung on copper-wired frames of PHENOLITE. Electrical impulses, passing through wires, alter the magnetic state of cores so that a group of them stands for a word or figure. Reversing the process recalls information from storage. PHENOLITE frames safeguard the circuit and permit stacking of core planes as shown.



**PHENOLITE MEETS CRITICAL STANDARDS.** Core frames like the one shown are punched out of laminated PHENOLITE by IBM. Each frame has printed circuit type terminal strips and soldered connections. PHENOLITE proves an ideal material for this application because it is mechanically strong and stiff, punches cleanly, etches well, remains flat, has high dielectric properties and withstands the heat of dip soldering.

**NATIONAL CAN HELP YOU** reduce unit product cost or improve product performance at no added cost. Here's why . . . You can select the "one best material" from over 100 grades of PHENOLITE, Vulcanized Fibre and National Nylon—without compromise in properties or cost. You can simplify production and purchasing with the timed delivery of 100% usable parts—from a single reliable source. You gain competitively with National's new materials and grades—the direct result of programmed materials-research.

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**MICRONIC LINE FILTERS** operating pressures to 3000 psi, 40 micron filtration, replaceable elements.

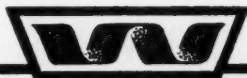
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has made great progress in the development of Solenoid Valves, Flow Regulators, Check Valves, Unloading and other valves for safe dependable controls.

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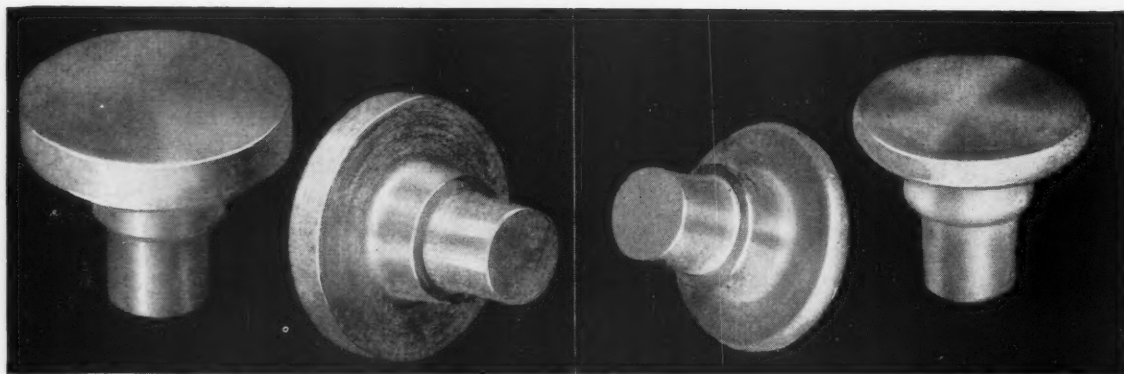
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The simple Flat Head Shoulder Rivet shown on the left above (enlarged), was slightly amended as seen on the right, to permit production by cold heading instead of by machining. The elimination of scrap loss, combined with increased speed of production, brought a saving of 80% to the purchaser.

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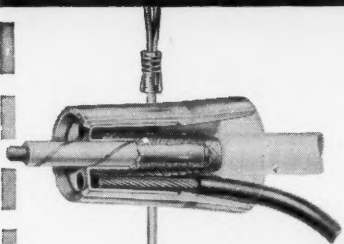
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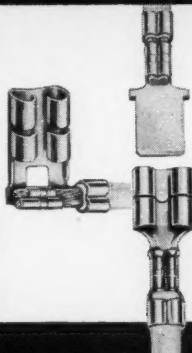
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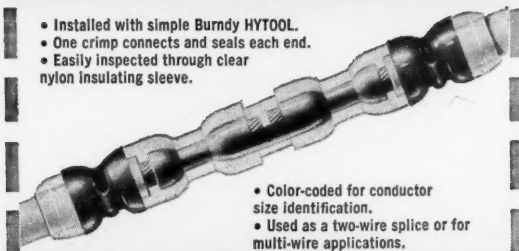
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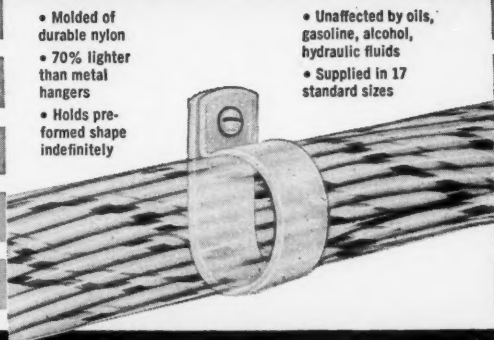
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costs less than  
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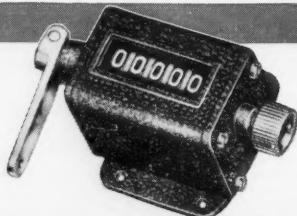
**VEEDER-ROOT**  
"THE NAME THAT COUNTS"



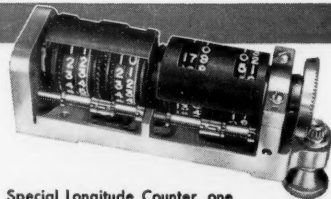
Series 1370 High Speed Counter (1500 to 2500 rpm) built into a wide variety of equipment.



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Special Longitude Counter, one  
of many made for aircraft navi-  
gational equipment.

## Personalities

### Important people who are in the news

When the Engineering Institute of Canada gets around to its annual meeting in Quebec City, Kenneth F. Tupper is the man who'll be taking office for the year 1958-59.

Tupper is president of Ewbank & Partners (Canada) Ltd. and one of Canada's leading authorities on atomic energy and jet propulsion. He was awarded the O.B.E. in 1947 for his work in these fields.



JEFFREY

TUPPER

J. Jeffrey has been appointed vice-president—administration of Dominion Engineering Works Ltd. Jeffrey obtained his early education in Edmonton and attended the University of Alberta and McGill University, graduating in mechanical engineering in 1935.

New manager of the Alberta district in CGE's wholesale department is Alfred M. Hurley.

Hurley joined the company in 1945 after wartime service with the RCN. He is a graduate in mathematics and physics of the University of Western Ontario.

Big night for the Ontario chapter of the American Society for Metals was the National President's Night held at the Prince George Hotel in Toronto on February 7. Many top company executives were on hand to meet ASM president G. M. Young (the first Canadian to be so elected) and ASM secretary Eisenman.

Eisenman, Young and Ontario chapter chairman Smallman-Tew are shown together on this page.

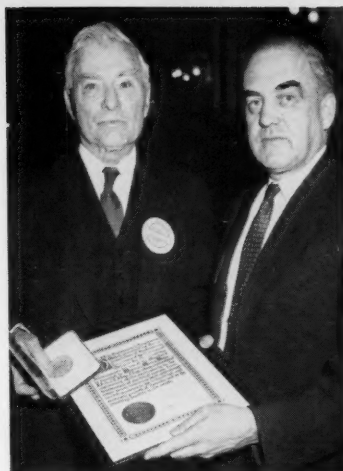
Stanley Herbert Ward, BSc, MSc, PhD, has been appointed to the staff of the Canadian development and research division of Inco. Dr. Ward will be directly concerned with the company's market research and development program, particularly in the industrial chemical field.

Two appointments at Bakelite Co. John F. Goudey, BSc, MEng, has joined the marketing and development group staff and R. James Wright, BSc, becomes silicones sales representative in the Central Ontario district. Goudey is a graduate of the University of Toronto and received his MEng degree at McGill. Wright obtained his degree in mechanical engineering from the University of Manitoba.

New western regional engineer for Canada Wire and Cable Co. Ltd. is N. R. Spencer.

Prior to this appointment, Spencer was the company's product engineer in their Toronto head office. He will now be located in Vancouver.

One of the highlights of the annual meeting of the Association of Professional Engineers of Ontario on the first of February was the presentation to Dr. Thomas H. Hogg of the Professional Engineers' Medal. Dr. Hogg, who is a former chairman of Ontario Hydro, is



HOGG

LORD

one of Canada's leading authorities on hydraulics engineering.

At the same meeting the Association's new president, Charles T. Carson, officially took over his duties from outgoing president John H. Fox. See the pictures at top right and bottom of this page.

Gold medal awards from the APEO to students in engineering graduating with the highest standing from the Universities of Toronto and Queen's went to John A. Norton of the former and Peter W. McBurney of the latter.



ABOVE: EISENMAN, YOUNG, SMALLMAN-TEW

BELOW: CARSON, FOX



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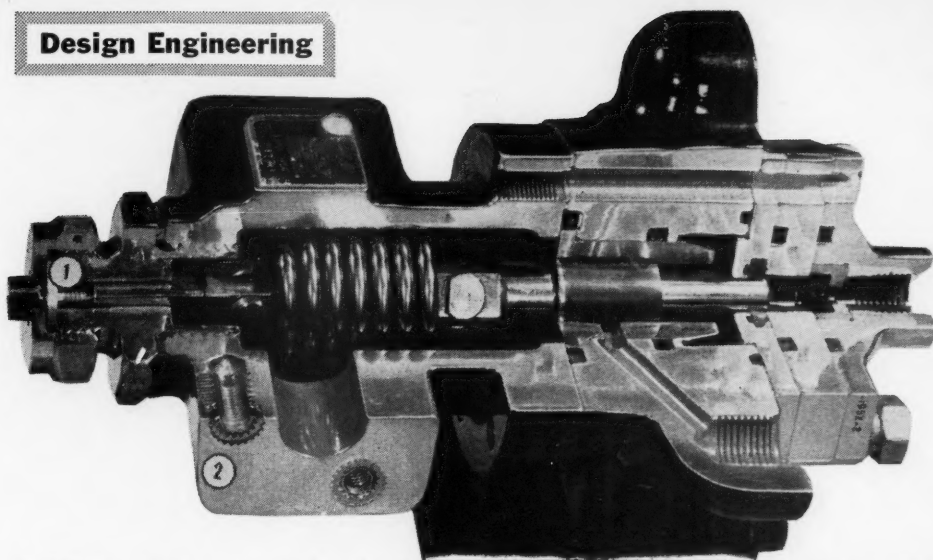
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## Design Engineering



1. "O" ring used as a face seal under flange of adjusting screw. 2. Robust 3-bolt flange at the high pressure inlet. "O" rings overcome a complex sealing problem in this fuel flow distributor.

# Sealing with present day methods

**"Machine design is a compromise and still very much an art"**

**W. E. Jones** ORENDA ENGINES

Ever since James Watt instructed his field engineer to tip a wheelbarrow full of horse manure into the top of the single-acting piston of his beam engines to reduce blow-by, sealing has been an acute problem in all branches of engineering design.

In this article, present day methods of sealing are discussed under these headings:—

- (A) Joint-face sealing;
- (B) Sealing a rotating shaft;
- (C) Sealing a reciprocating shaft or piston.

### (A) Joint-face sealing.

The static sealing of a plain bolted joint (whether this be a flange on a high pressure pipeline or a light joint-face in an aircraft assembly with only a few inches of water pressure across it) tries the ingenuity of the design engineer, and the patience of the development engineer, in arriving at a satisfactory solution.

Face leakage troubles that reveal themselves during the development stage, but which sometimes persist into field service, can usually be traced to an enthusiastic designer who has pared the weight down to the last ounce, regardless of rigidity. Even when rigidity is a design factor (as, for example, in assessing bearing loads), the possibility of assembly joint faces deflecting enough to permit leakage seldom comes up for special consideration. Some of this trouble is due to the present-day trend of assuming that all machine design can be found in "the book" and a tendency to forget that good design is a compromise and still very much an art.

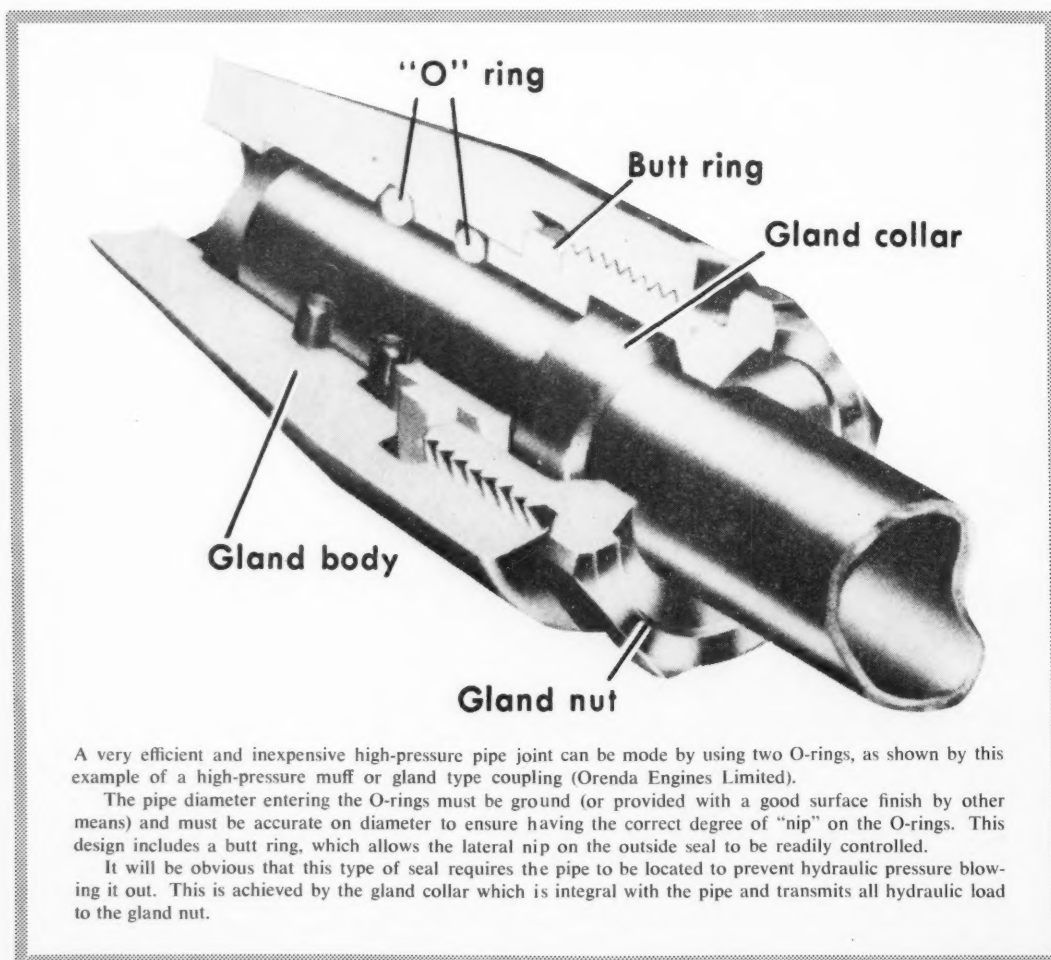
Any joint-face that has to hold oil must be designed to a certain minimum degree of rigidity. If the rigidity can be high and if, at the same time, a high degree of machine shop accuracy and surface finish is maintained, no separate joint seal should be necessary for pressure drops up to 5 psi. If, due to the need for light design (or wide bolt spacing), the face between the holding points can "pant" (Fig 1) some joint will be necessary.

In many cases where precise dimensions have to be maintained, flexible joints cannot be used, but where assembly dimensions are not important a full face-joint of a bonded, fibrous material (or thin synthetic rubber) is usually employed. Such joints quite often reduce the cost of manufacture, because an increase in machine shop tolerances is usually permissible. In use, these joints keep the space between the bolts filled, by causing a small initial deflection or bowing between these points and behaving subsequently as a very short, high-rate spring filling the space. In precision assemblies where any form of flexible joint is prohibited, a synthetic, non-setting jointing compound can be used. This compound, by remaining fluid, will stay in the joint in sufficient volume to seal pressure drops of up to 5 psi; it is particularly effective where very high frequency vibration is encountered. (Vibration is a well-known cause of joint-face leakage in high speed machinery).

For pressure drops above 5 psi, and up to high pressures of 2,000 to 3,000 psi, the synthetic rubber O-ring is common practice where light weight is important, as in the aircraft field. Joints where this practice

can be employed include not only the asymmetrical face-joint, but also the high pressure flange and the muff type of fluid coupling below. For very high pressure joints of this type (such as those employed in gas turbine fuel systems), accurate manufacture of both the O-ring and its housing is essential. Generally, the designer's objective is to arrange matters so that the housing is completely filled with rubber without ever becoming over-filled. Limits and tolerances must be such that the rubber never tends to overflow from its housing. This usually requires the manufacturing of O-rings to very close tolerances. A ring of  $\frac{1}{8}$  to  $\frac{3}{16}$  in. section may require limits of  $\pm 0.0015$  in. The O-ring manufacturer always objects to this (or just fails to achieve it), with the result that the machine shop has to hold even tighter limits on the housing. If the effort is made, however, it is possible to assemble such joints so that, under a pressure of 2,000 psi of gasoline, they will pass the "chalk test."

This is a simple but effective way of detecting very small leaks, particularly where hydro-carbon fuels are concerned. An area of microporosity in a light alloy casting (or forging) will often allow fuels under high pressure to weep through, although the porous area itself is not visible under X-ray. In these cases, it is often necessary to carry out a detailed examination of



A very efficient and inexpensive high-pressure pipe joint can be made by using two O-rings, as shown by this example of a high-pressure muff or gland type coupling (Orenda Engines Limited).

The pipe diameter entering the O-rings must be ground (or provided with a good surface finish by other means) and must be accurate on diameter to ensure having the correct degree of "nip" on the O-rings. This design includes a butt ring, which allows the lateral nip on the outside seal to be readily controlled.

It will be obvious that this type of seal requires the pipe to be located to prevent hydraulic pressure blowing it out. This is achieved by the gland collar which is integral with the pipe and transmits all hydraulic load to the gland nut.

the area that is leaking. To find this location, the surface of the component is thoroughly cleaned and dried and then covered lightly with common chalk. During the subsequent pressure test, an immediate indication of the presence of leaking fuel at the surface is given by the appearance of dark spots in the chalked area. The same technique can be used at any suspected joint or as a proof test of a joint; the presence of the slightest trace of fuel will be visible to the naked eye.

The subject of the rubber mixture specification for O-rings for use with different fuels or oils cannot be dealt with in detail, but it is most important that the design dimensions taken for the finished O-ring are those which apply after the material has absorbed its quota of the fluid with which it comes in contact, and is therefore at its stable volume. Most mixes in contact with fuel reach a stable condition after about 100 hr, but some manufacturers often store seals in fuel until ready for assembly, to ensure that their volume has stabilized.

#### (B) Sealing a rotating shaft.

It often happens that the sealing of a rotating shaft (which at first might appear more difficult) turns out to be easier than the sealing of a static joint. The reason is that, for moderate rotational speeds, the sealing techniques to be employed are better established. Where high rotational speeds (of about 50,000 rpm) are encountered, the sealing problem is again acute and orthodox seals have to be very carefully applied. The application of radial contact seals to high speed shafts first of all requires the establishment of the correct design, after which success or failure in production is largely in the hands of the manufacturing and inspection departments.

A variety of designs are available for such applications, and there are, of course, many applications where special designs have to be made. However, in sealing a shaft in the medium speed range (from 2,000 to 10,000 rpm) with a pressure drop range of  $-5$  to  $+20$  psi, the synthetic rubber, pre-loaded lip seal shown in Figs 2 and 3 may be suitable. Design features are as follows:

- (1) A mixture specification has to be chosen for the seal that is compatible with the fluids with which it is in contact and the range of temperatures encountered.
- (2) The geometrical form of the contact lip is important. It must permit equal radial pressure around the shaft with the minimum possible width for contact.
- (3) The seal housing must be concentric with the lip and constructed to support the seal in such a way that it can withstand the design pressure-drops, without causing lip distortion.
- (4) The shaft must be round and must run true.
- (5) Surface finish at the point of contact with the seal should be 1.5 to 2 micro-in. RMS. A good ground finish is preferable.
- (6) The shaft must be hardened at the point of contact with the rubber.

Any lack of accuracy at the shaft (due either to eccentricity or out-of-round) causes the seal lip to move cyclically at shaft frequency in trying to maintain contact. Due to the nature of the seal as a dynamic system, and the relatively large amount of damping present, the seal soon finds it impossible to "follow" the shaft and a leakage gap results. The familiar "garter" springs increase the spring rate of the seal to enable contact to be maintained at higher speeds.

Seals of this type rely on maintaining a fluid film between the lip of the seal and the rotating shaft. The

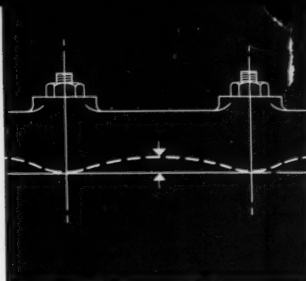


Figure 1

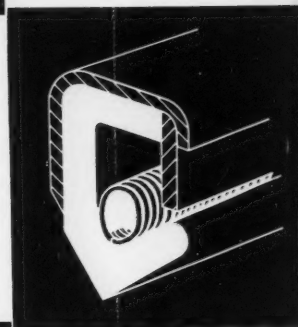


Figure 2

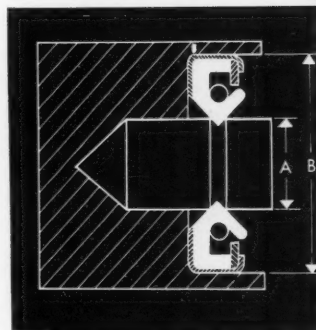


Figure 3

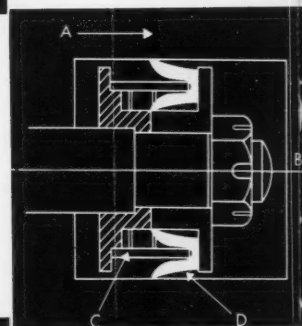


Figure 4

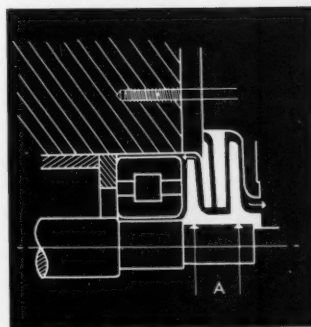


Figure 5

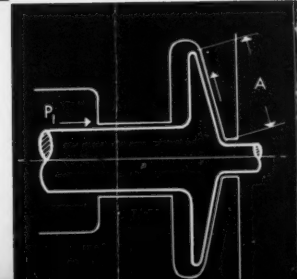


Figure 6

seal will rapidly fail if this film is removed. It is, for instance, quite impossible to use such a seal satisfactorily if it is not in constant contact with the fluid it is sealing.

### (C) Sealing reciprocating shaft or piston

Another field of sealing problems is concerned with preventing (or reducing to an acceptable level) the leakage of fluid or gas past a reciprocating shaft or piston. Pressure drops in these cases are often very high and rubbing velocities can reach high peak positive or negative values. To make matters worse, the nature of the design of a sliding pair is usually such that the axis of one element cannot always be constrained so as to remain concentric with the other element of the pair. A piston, for instance, will rock slightly in its bore (or a shaft be pushed over to one side of its housing), due either to the cyclic motion or to hydraulic unbalance.

The most familiar design in this field of sealing is the piston ring (or rings). This, however, is not satisfactory for high pressure hydraulic work; it is inefficient as a seal and has a high hysteresis factor.

For applications where no leakage is permissible in excess of the inevitable wetness of a rubber seal, the

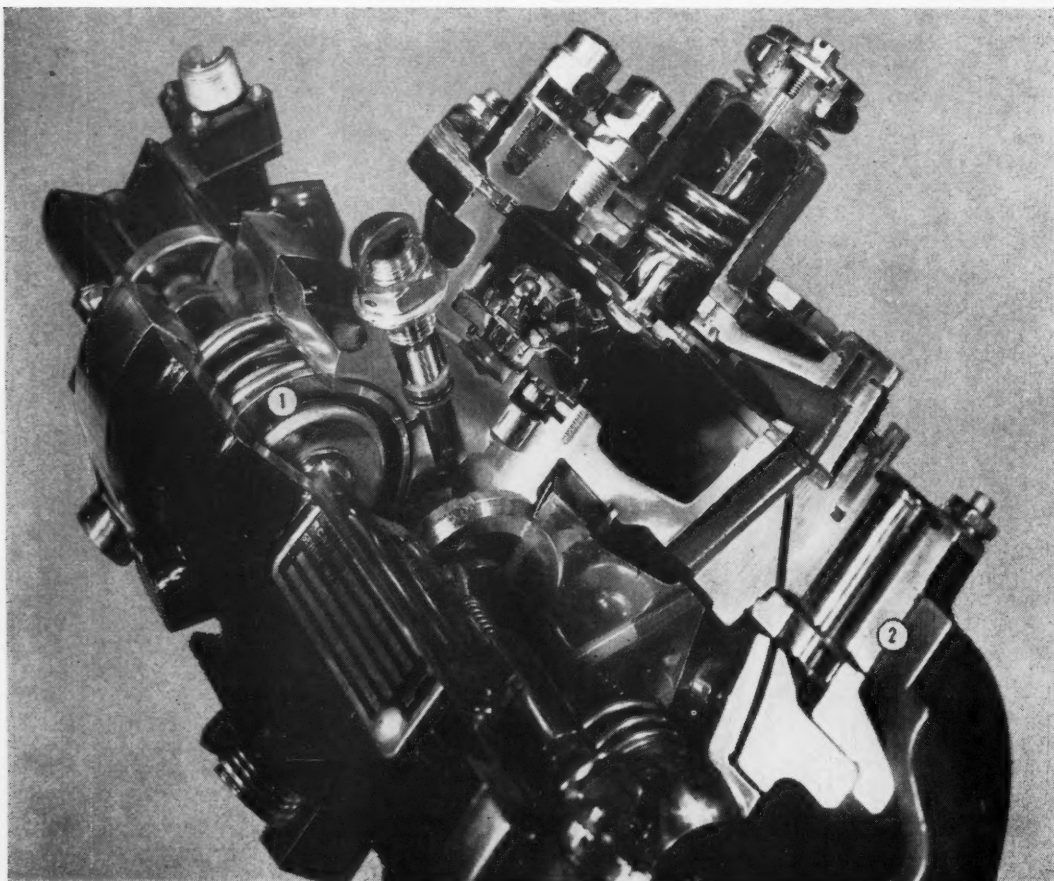
V section (or chevron) seal, when correctly supported and housed, is very efficient. An example of such a seal applied to a hydraulic servo motor is shown in Fig 4. The section of the seal is most important and it must be held flat against its backing plate by means of a short but carefully designed spring. Some of the more recently developed plastics for this application are highly efficient as seals and remarkably free from friction, even at large pressure drops.

Where pressure drops are not too high, the rolling seal is effective. In this design a very flexible diaphragm is substituted for the usual piston, this diaphragm being contained by the cylinder and the shaft.

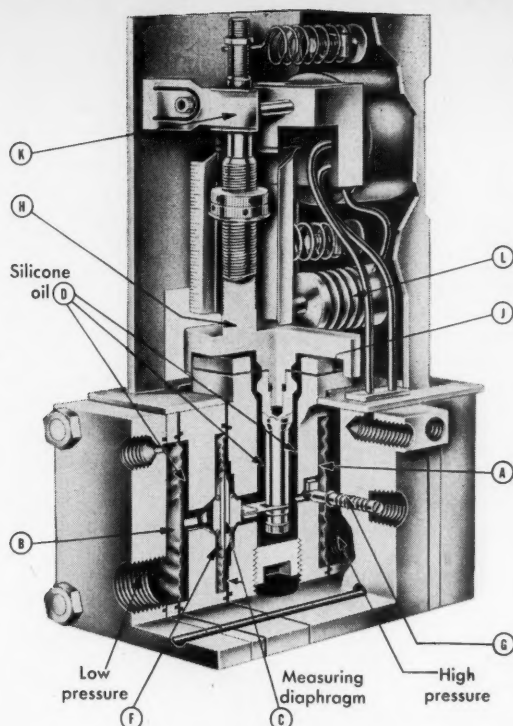
The carbon **face seal** is well-known because of its extensive use in automotive water-pumps. Its application to the sealing of oils and fuels becomes more difficult because of the tendency for some carbons to "ball-up" in oil and, as a result, to score the metal in contact with the seal. Such seals are used successfully on gas turbine engines and on their fuel systems, particularly where the loading of the seal can be light and where centrifugal force can be made to assist in sealing.

The basic principle of the pressure balanced seal (Figs 5 and 6) is that the pressure drop across the "rotating pair" is more than balanced by a centrifugal pressure generated at the downstream side of the leakage path. While stationary (or at low speeds), a contact seal comes into use but moves out of position as soon

*At 1 is the high pressure piston seal shown enlarged in figure 4. At 2 is a precision face joint with 20 psi pressure differential to atmosphere. Rigidity, close bolt spacing, good surface finish are absolutely vital.*







## Flow meter that keeps a measuring circuit in oil

### A design that reduces maintenance and still provides rapid response

A force-balance differential pressure flow meter (or transmitter) that features a measuring circuit completely immersed in silicone oil is announced by Fischer and Porter (Canada) Ltd. The design (Model 10B 1465) reduces maintenance and keeps extraneous forces out of the force balance circuit, yet provides rapid response to differential pressure changes.

Range changes are easily made and zero adjustment is external. The new transmitter operates up to 1,500 psig working pressure with complete over-range protection. Calibration stability under changing temperature or pressure conditions is exceptional.

Through-bolt construction permits easy removal of the unit without disconnecting flanges from the process piping.

The input pressures are applied to high pressure (A) and low pressure (B) sealing diaphragms and are transmitted to the measuring diaphragm (C) by the silicone sealing oil (D) which completely fills the chambers between the diaphragms. Over-range protection is achieved by O rings (F) mounted on the central rigid portion of the measuring diaphragm. Under either high or low over-range, these O rings are forced against the beveled surfaces of the body block, prohibiting the flow of oil from the measuring-diaphragm chamber to the sealing-diaphragm chamber. This sealing action removes the overpressure from the measuring-diaphragm, since the "lock-in" oil forms an incompressible barrier that exerts an opposing pressure to the over-range on the measuring diaphragm.

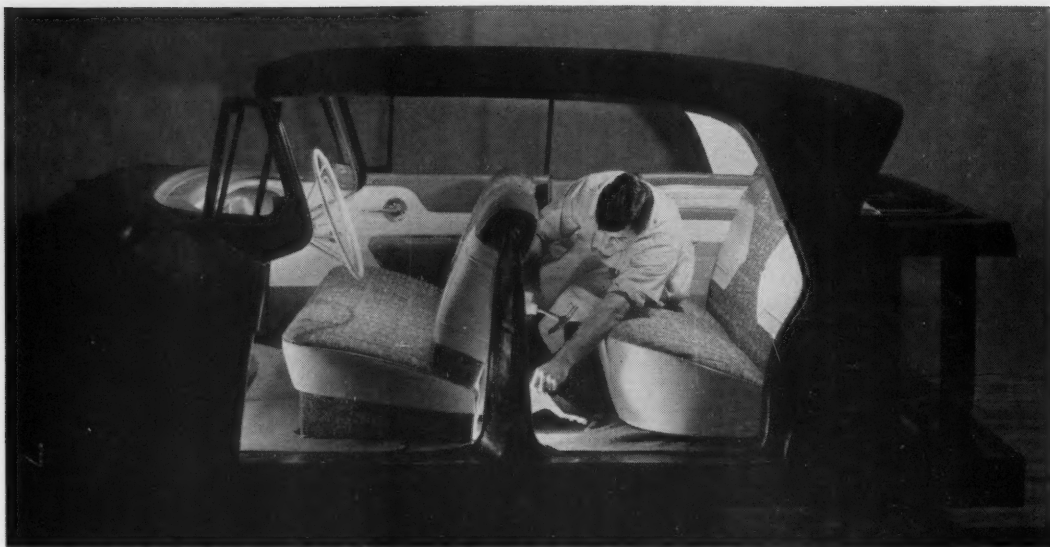
Adjustable damping is achieved by a needle valve

(G) restricting the flow of oil from the high pressure diaphragm chamber to the high pressure side of the measuring diaphragm. Since the needle valve is in the clean sealing oil, its operation is trouble free, regardless of the amount of damping used.

Under an increasing applied differential pressure, the measuring-diaphragm exerts a force on the force rod (H) which, if unopposed, would rotate the force rod in a clockwise direction about the cross-spring flexure located at the force rod sealing diaphragm (J). A minute motion (much less than 0.001 in.) at the upper end of the force rod reduces the clearance between the nozzle and flapper of the detector pilot (K), thus increasing nozzle back-pressure.

This change in nozzle back-pressure increases the non-bleed type amplifying relay output pressure and is immediately transmitted to the feedback bellows (L), increasing the force exerted by the bellows on the force rod. This force opposes the initiating force of the measuring diaphragm on the rod and would (if unopposed) move the rod in a counter-clockwise direction about the cross-spring flexure.

In this manner, a continuous force balance between the applied differential pressure and transmitter output is achieved. The location of the range adjustment determines the magnitude of the feedback torque applied to the force rod, permitting easy range changes. Force rod motion is extremely small; less than 0.001 in. at the nozzle is needed to change the transmitter output from 3 to 15 psig, thus reducing mechanical effects on accuracy to a minimum. ★



1. Final test of the interior design is offered by means of a custom-built trim buck fitted with the same materials as those proposed for use in the actual production models. Here a craftsman installs upholstery.

## Models—hard sense and make-believe

No mere window dressing but money in the bank for the cost-conscious

**John W. Dennis** ASSISTANT EDITOR

Scale models, long considered the territory of the hobbyist, have come far and fast recently. They have found a wide range of uses in the past twenty years. They are big business.

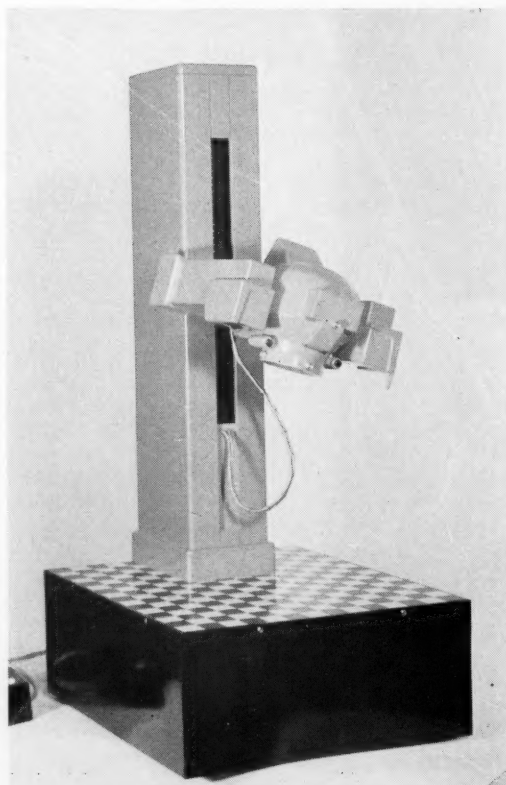
In such fields as product development, architecture, plant layout and terrain maps, to name a few, cents sown over the design stage usually mean dollars reaped at the end. "At present many firms will not discuss contract terms unless a model is specified," is one businessman's claim. He adds, "The time is not far distant when a model will be considered as necessary for a job as the specifications and drawings."

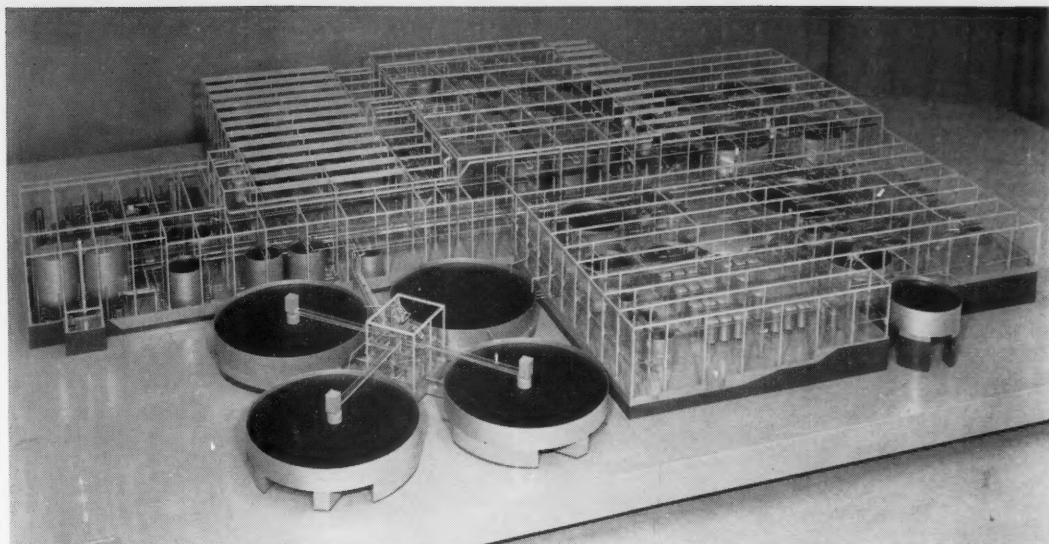
One of the biggest fields of expansion for the professional modelmaker has probably been in the realm of product development and the automobile is a first class example of this (Figs 1, 7, 9 and 10).

For the automaker, who has precious little leeway for mistakes if he wants to get and keep customers, sketches establish the general trend of the design and are followed by full-scale working drawings. A clay model, at full-scale, is made from these drawings and molded by skilled modelmakers over a rough wood frame known in the modelmaking fraternity as a "buck." This clay model serves as a pattern for making the molds which will be used to fashion a prototype in plastic and metal. The production drawings will be made from this prototype.

The money that the automaker saves by trying out his ideas for moldings, trim, color, fabric and accessories via a model can run to fancy figures.

2. Quarter scale model of cobalt 60 treatment unit. ▶





3. At 3/16 in. to 1 ft. this model of an uranium ore processing plant contains a mass of detailed piping. A technique that's getting great acceptance in the U.S.A. is the use of photographic plans direct from the model.

A second type of product development model (Fig 6), finds it used in an equally important but very different role. Here the model, full size, is of a component which may have moving parts and can be fitted to the machine it will serve and allowed to operate on a short time basis. Now the wise manufacturer can see where any faults in design may lie, how well its parts work together and how weight and machining steps can be saved.

In architecture too, the model is as vital a link as in the product development chain just mentioned. The architectural model, however, concerns itself more with a set of relationships. The relation of windows, moldings, color and texture of the outside walls to the shape of the building itself, the relation of the building to its site and to the buildings already in the surrounding area. The model has, to an extent, become a sales aid. Such a model is shown in Fig. 8.

### **They force decisions**

Mushrooming field for the modelmaker is that of plant layout (Fig 3). In large and sprawling plants such as refineries, a model can offer advantages unobtainable in drawings. They save engineering and drafting money, help to force decisions more quickly and are just plain easier to work from. Even an expert can tie himself up in knots over a piping diagram.

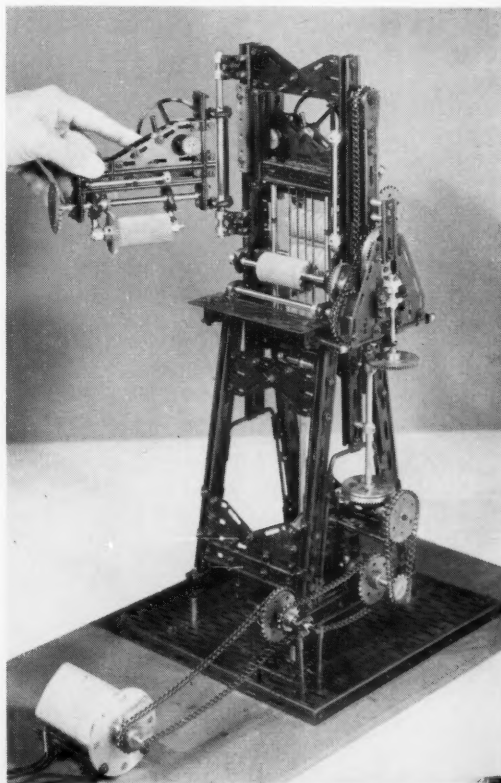
No model has a more direct use or, perhaps, a greater appeal than the working model which can be a sales, training and design aid rolled into one neat package. Such a model was used recently in the pulpit or control house of a new mill. The men who were to be at the controls could practice on the model and felt right at home when the actual pulpit was installed.

Working models can aid in the design stage (Fig 2), in the operation of complicated machinery (Fig 4) and, in the laboratory, be assembled to perform intricate testing procedures.

4. Detailed kit-based working model of a log saw. ▶

Management that balks at the expense of professional modelmaking would do well to take a tip from Ontario Hydro. The St. Lawrence power project, rightly the subject of much space in the Canadian news recently, is the case in point.

Hydro chalked up a net savings in construction cost





5. Like something from Gulliver's Travels, Hydro engineers dwarf the St. Lawrence landscape as they mold and measure the flow of the revamped Seaway waters.



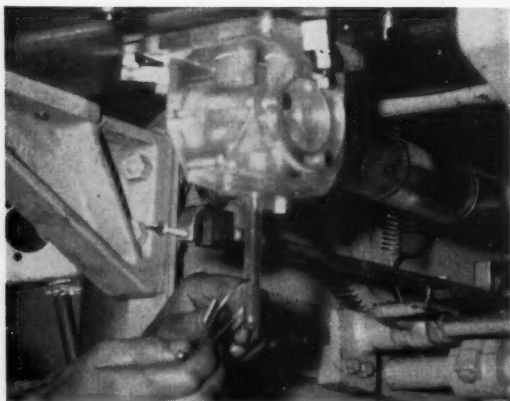
of more than \$5 million thanks to the models they made of the Sir Adam Beck project at Niagara. They expect to make even greater savings through their St. Lawrence models!

Before the official start of construction on the project in 1954, Ontario Hydro carried out extensive preliminary investigations on its first three St. Lawrence models (Fig 5). Hydro engineers accurately reproduced a 35 mile stretch of the river, simulated actual river conditions and duplicated to scale the shoreline, contours of the river bottom and turbulence and currents of the water. The largest of these models, covering over 5,000 sq. ft. and containing the power house and the Long Sault Dam, is 146 ft long and has a maximum width of 40 ft.

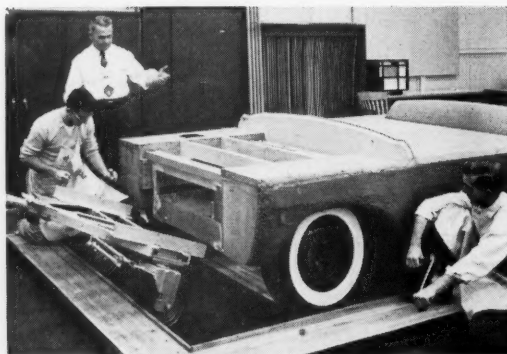
So much for some of the principal areas of professional modelmaking. Where do the skilled men come from?

There are no current courses that train modelmakers and, at the present time, prime qualifications of a man looking for such a job are an ability to use woodworking tools, a working knowledge of engineering drawings and being just plain "good with his hands."

Large construction and engineering companies can usually justify model shops of their own on the basis of cost and time paring, where smaller companies would find the proposition uneconomic. The latter, however, can resort to the many highly competent modelmaking companies now existing in Canada. Most



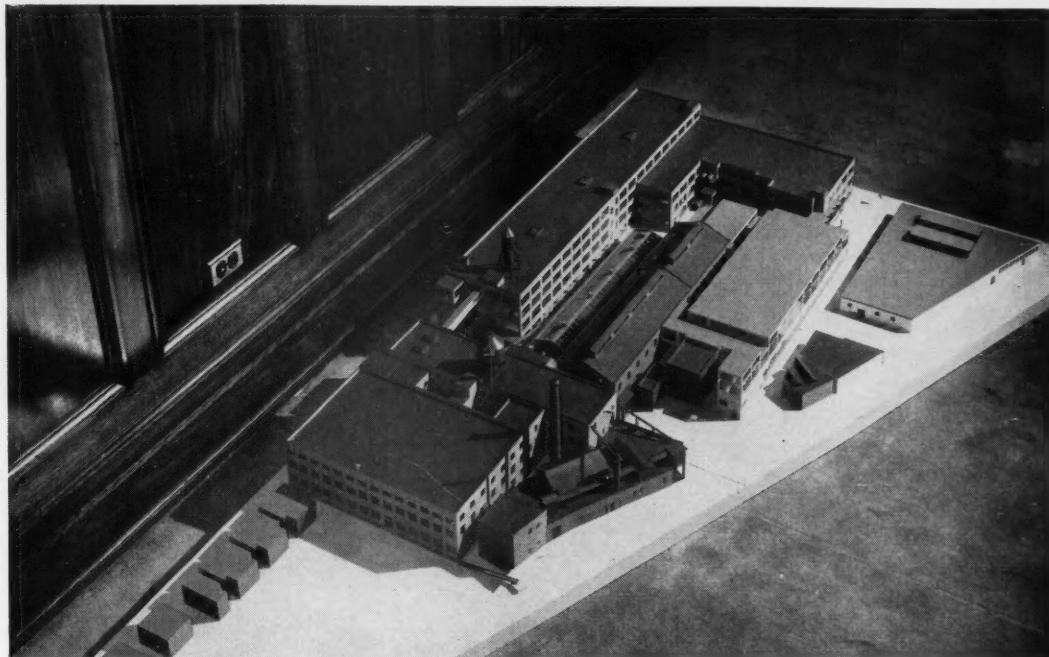
6. Model of a valve is fitted to a filling machine.



7. Here the buck is set up. Made of hardwood strips, it must support the 5 tons of clay used in completed model. Buck must be exactly level from front to rear.



8. This model of the buildings in a rubber plant is at a scale of 1 in. to 10 ft. Models of this type let architect and company see how their plant will look.



The model credits are: 1, Ford Motor Co.; 2, 3 and 8, Design Craft Ltd.; 5, Ontario Hydro; 6, Rohm & Haas Co.; 4, FAC Division; 7, 9 and 10, Chrysler Corp.

of them are comparative newcomers to a field which has gained in importance since (and partly as a result of) World War II.

The modelmaker's materials (once wood almost exclusively), have branched into an enormous family embracing plastics, card, composition boards and a wide range of light alloys.

A visitor to a well-equipped shop would find nearly all the woodworking tools common to a cabinetmaker's shop plus a fair range of machine shop equipment.

A "do-it-yourself" technique available to the design engineer who wants to try out various solutions to a problem is the model engineering kit. These excellent kits are composed of finely made parts and, although initially expensive, can be torn down and used

again and again. The model in figure 4 is an example of an assembly made from such a kit.

Included in the kit are ball bearings, spur, bevel, internal and worm gears, gear racks, ratchets, sprockets and so forth. From such components reciprocating motions, geared transmissions, differentials and sprung devices can be created easily.

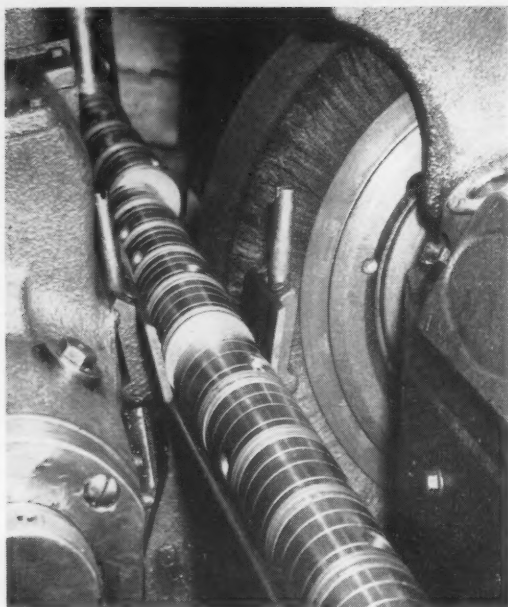
The model has moved from the basement and is no stranger to the engineering office and board room. It makes hard-headed sense in design engineering projects and is anything but a frill to product development. Time, cash and experienced brain power spent on a model at the early stages of any project will return supremely handsome dividends before that project is carried through to its conclusion. ★



9. After two months the roof supports are added and clay build-up has started on the rear fenders. Full scale study can be seen on board in the background.



10. Six months after management okay on a design program the clay model is complete. The model gets no paint but exterior trim is simulated by bright foil.



1. Line of pistons being finished to micro-smoothness.

The principles of centreless grinding have been known and used for some time. In centreless brushing, Osborn has applied the same basic principles to automatic brushing methods. The grinding wheel is replaced by a large diameter brush. Brushes filled with wire, tampico, Korfil or synthetic brush fill materials can be used, depending on the type of work material and finish desired.

Centreless brushing is a process wherein the part or work is not supported between centres. A centreless brushing operation can be performed on standard commercially available centreless grinding machines or on specially designed equipment using the basic method. Production machines for this purpose may be arranged and combined in a number of different ways, but the fundamental principle involved is the same in all cases.

The centreless brushing machine for external cylindrical or formed work consists of two wheels, each mounted on a horizontal axis with the wheel surfaces opposed to each other, as shown in Fig 3. An adjustable work-supporting blade is mounted between the two wheels. The larger wheel (referred to as the brushing wheel) is of 20 in. diameter. This wheel is mounted directly on a standard 14 in. O.D mounting hub, equipped with suitable balancing weights properly adjusted to obtain the optimum dynamic balance for the brushing wheel. The smaller wheel (known as the regulating wheel) rotates slowly and acts as a brake to prevent the work from spinning whilst in contact with the brushing wheel. This determines the rotating speed of the work. The regulating wheel also acts as a work support and, when tilted, feeds the work transversely across the brush face. The axis of the regulating wheel can be tilted from horizontal to feed the work continuously across the face of the brushing wheel. The rotational speed of the regulating wheel is adjustable either through a rheostat control or change gears. Each time the regulating wheel is adjusted in angularity, it is necessary that the face of the regulating wheel be made true with the pass line of the work. To obtain this

## Brushing parts that have no centre support

R.C. Sasena

THE OSBORN MANUFACTURING CO.

relationship, a truing device is incorporated in the machine. The work rest blade supports the work as it moves past the brushing face. The thickness of the work rest blade will vary with the diameter of the parts being brushed.

The centreless principle of surface grinding and finishing may be divided into two general methods namely: **through-feed** and **in-feed**. Modifications of these two methods make it possible to adapt the process to a large variety of work. The **through-feed** method refers to that work which can be fed past the brush and continue out on the other side of the machine in a continuous, non-interrupted motion. Frequently, parts are processed using the through-feed principle where there is more than one diameter, machined or ground on the external surface. For example, parts for through-feed centreless brushing would be of the general shape shown in Fig 4, where the brushing action would be concentrated on the largest diameter surface. However, the large diameter must be sufficiently long to permit the regulating wheel to feed the work uniformly in such a way that the part will not be tilted or cocked as it is moving through the brushing wheel. The decision as to whether a part can be through-fed depends largely on the ability of the regulating wheel to feed the part past the brushing wheel in a uniform, straight-line motion. The **in-feed method** of finishing is usually applied to headed work (such as bolts, where the cylindrical body only is ground) or to control valves where the external surfaces of the valve lands are finish ground and may be of different diameters. For this type of work the wheels used are of a width that more than covers the length of the surface to be finished. Parts for in-feed centreless finishing would be the type shown in Fig 5. In this case the work is fed into the brushing wheel to an adjustable end stock at the rear of the machine to prevent the work from entering between the two wheels. This end stop also ejects the work at the finish of the cut or brushing. When loading or removing the work, the regulating wheel is moved on its slide away



2. Rough grinding takes .006 in. from these nickel-moly steel rods. Finish grinding takes off another .002 in.

### Centerless Brushing after final grind

Piston pin number	Micro-inch finish after final grind	Brush used	Micro-inch finish after one pass at 8.3 ft/min.
1	19.7	.005 in. wire	11
2	13.6	"	7.4
3	9.7	"	7.1
4	19.3	Fascut and Compound	8
5	9.0	"	5
6	7.1	"	6.8
7	19.2	"	9.1
8	19.5	"	9.9
9	19.5	"	11.3
10	19.1	"	10.6

### Centerless Brushing after rough lap

Piston pin number	Micro-inch finish after rough lap	Brush used	Micro-inch finish after 1 pass at 8.3 ft/min.	Micro-inch finish after 2 passes at 8.3 ft/min.
11	5.8	#16 Cord	3.4	2.3
12	6.1	"	3.6	2.1
13	5.0	"	3.7	2.4
14	5.8	"	3.7	2.6
15	5.5	"	3.5	2.9

from the face of the brushing wheel so that enough clearance is obtained to avoid contact of the work with the brushing wheel face. It would be necessary to shape the face of the brush to fit the contours of the part.

The centreless brushing method is capable of a high degree of automation and integrating with other in-line processes. There are several types of commercially available mechanical and electrically operated mechanisms for automatically feeding parts through a centreless machine. For example, the vibrating hopper is one type of mechanism capable of feeding a wide variety of small parts through an in-line process. If it is necessary to apply an abrasive compound to the brushing wheel, this can be accomplished by the use of a commercially available compound applicator where the compound is in bar form. It is also possible to spray a liquid type compound on the face of the brushing wheel. After the part has been processed through a series of pre-brushing and brushing operations, it is also practical to consider gaging or inspecting equipment in order to ensure finished product uniformity. Depending upon the degree of mechanization, the inspection equipment can be designed to sort the parts and, through the use of specially designed storage racks, the parts can be automatically stacked. The use of storage racks to accept the finished parts is an important feature in any automatic or integrated process and is equally important at the beginning of the line as at the finish of the line.

A typical application is shown in Fig 2. A centreless grinder used for rough grinding, taking off 0.006 in. from the surface of nickel-moly steel pump rods. A finish grind takes off another 0.002 in. and the machine is then applied for centreless brushing.

The action of the brushing is that of blending slight but important imperfections and surface irregularities rather than actual removal of metal. Brushes produce an effect on the surface that is not confined to the high spots but actually refines the entire surface. The result is that the edges of pits and grooves in the metal surface are so blended as to change the focal stress pattern very favorably. Even the corrosive action of these rods is reduced.

Centreless brushing of these pump rods (varying in diameter from 1 1/8 to 1 1/2 in. and in length from 6 to 36 ft) is shown top left. The operation of the machine is relatively easy. One man places the rod on the feed carriage. The regulating wheel (which runs at 52 rpm) is placed at a slight angle, thus forcing the rod past the wheel surface. In a matter of minutes, the entire rod is brushed and passed on to the next operation.

In addition to surface refinement to enhance corrosion resistance, a centreless brushing method is helping a manufacturer of pistons remove the residues and sharpness after grinding. This makes assembly easier and, in addition, prolongs the smooth working life.

A 20 in. diameter wire brush is used on standard centreless grinders. The brush has a 6 in. face and is made with a suitable grade of tool steel wire. The pistons are machined, ground and then brushed. The work is gravity fed from a magazine type chute (Fig 1). A small driving wheel (set at an angle) rotates the parts and drives them through the brush area. The brush rotates at 1,200 rpm.

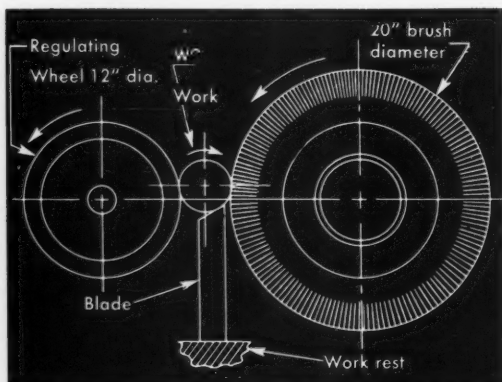
Osborn Matic brushes (filled with 0.008 in. wire and coarser) are generally used for producing satin finishes, for roughening surfaces and for cleaning to remove rust, loose scale and shop dirt. Brushes filled with 0.005 in. wire are capable of producing fine satin finishes, removing surface contamination such as metallic



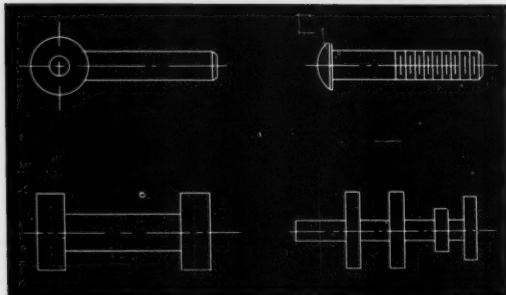
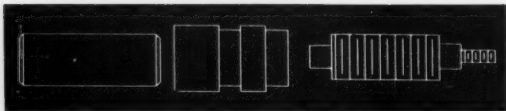
oxides, heat discoloration, light scale and improving the surface finish on rough and finish ground surfaces. These brushes (when used in conjunction with an abrasive compound) are capable of even further surface finish refinement. Brushes filled with treated tampico, Korfil or No. 61 Cord are suitable for light burr removal, light scale or surface discoloration removal, and for producing surface finish refinements in the range of 12 to 3 micro inches.

The laboratory data shown tabulated was obtained by the centreless brushing of production ground parts. It illustrates the degree of surface refinement obtainable under controlled conditions. The parts being centreless finished are automotive piston pins approximately 3.25 in. long and 1 in. OD. This part of the manufacturing process involves rough grind, final grind, rough lap and finish lap. The data may be summarized as follows:

- (a) Wire-filled brush can be used to obtain some degree of surface improvement in Samples 1, 2 and 3.
- (b) Fastcut filled brushes are capable of appreciably improving the surface of final ground parts. It was found that when surface roughness had been reduced to 8 to 10 micro-inches, further gains would be best made using cord-filled brushes.
- (c) Cord-filled brushes should be applied as a final finishing tool where surface finishes in the range of 2 to 5 micro-inches are required. ★



Figures 3, 4 and 5 from top to bottom of diagrams.

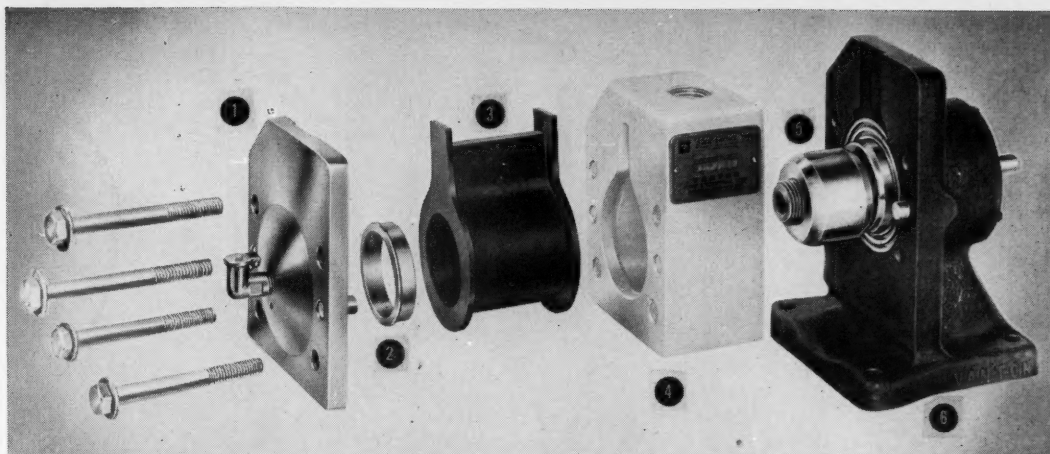


## Applications

Centreless brushing applications may be found in a broad industrial market because of the versatile use of the basic method. These are typical:

- Removal of grinding burr from the lands of valves used in automatic transmissions.
- Cleaning bar stock.
- Roughening for adhesive purposes.
- Electrical rotor assembly; brush OD of laminations to remove foreign matter.
- Remove burrs from round steel blanks.
- Centreless ground cylindrical tubing to improve finish.
- Piston pins to remove grinding burr.
- Improve finish on OD of roller bearings.
- Improve finish on OD of bearing race.
- Blend grinding operation feed wheel lines from steel rod stock.
- Remove burrs and improve finish on various small shafts and cylindrically shaped parts used in comparators, cash registers and other calculating machines.
- Improve finish on hydraulic cylinder piston rods.
- Refine surface on 410 stainless steel round bars.
- Removal of nitride film from ground threads on jack screws.
- Remove grinding burr from valve pistons.
- Improve finish on OD surface of socket wrenches.
- Satin finish aluminum tubing for appearance.
- Satin finish brass tubing for appearance.
- Remove burr from steel brushing.
- Improve finish on pump shafts.
- Improve finish and remove light burr and roughness from the threads on steel micrometer screws.
- Improve finish on steel oil-pump rods.
- Remove graphite and dirt deposit from valve guide rods.





Breakdown of parts: 1, Cover plate; 2, Expansion ring; 3, Liner; 4, Body block; 5, Rotor; 6, Pedestal assembly.

## A pump eliminates the need for seals

### A flexible liner gives the answer

The most serious problem with chemical pumps is stuffing box or shaft seal leakage. The design of the Vanton Pump and Equipment Corp. flex-i-liner pump has eliminated the need for stuffing boxes, packing glands or mechanical shaft seals of any sort and, therefore, eliminated completely the possibility of hazardous and wasteful external leakage.

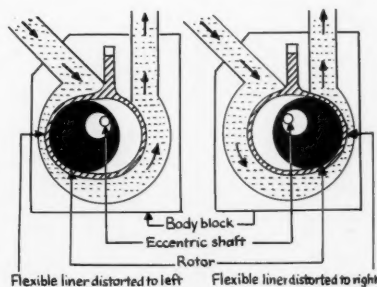
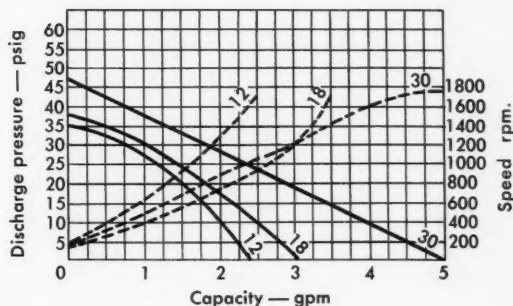
Further, the problem of contamination of the transferred fluid by oil or grease is avoided and a costly maintenance factor done away with. Abrasive slurries which would normally score shaft seals are readily handled by the pump. Stuffing boxes or shaft seals are not needed since flanges on the flexible liner straddle the body block and are pressed to its sides by concentric grooves in the bearing pedestal and cover plate.

Thus the fluid is confined to a channel formed by the outer surface of the liner and the inner surface of the body block, while all mechanical action and moving parts are on the inside of the flex-i-liner.

Internal valves are not necessary since the momentum of the fluid flowing through the pump prevents back flow as the rotor hits the top of its stroke and crosses from discharge to suction. The absence of valves adds to the simplicity of construction and eliminates maintenance due to stickiness and valve wear. Sensitive fluids which might otherwise be damaged by the opening and closing of check valves are readily handled by this pump. The absence of gaskets further eliminates sources of leakage, maintenance and contamination.

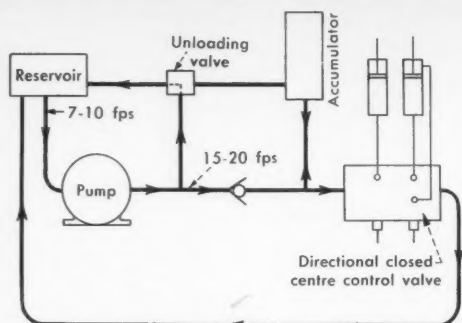
Flex-i-liner pumps will develop vacuums up to 26 in. Hg and readily handle gas, liquid or viscous fluids. The pump will prime itself in any operating position without priming devices. Air bubbles will not cause locking or seizing of the pump or impair its efficiency.

The gentle pumping action prevents churning or foaming of the fluid. This not only prevents excessive settling out of suspensions, but also avoids the breakdown of latex emulsions and other liquids. ★



**It pumps like this.** The rotor is mounted on an eccentric shaft, which rotates within a flexible liner. This creates a progressive squeeze action on the fluid trapped between the liner and the body block.

Shaft seals and packing are eliminated because the fluid is isolated from all actuating mechanisms or rotating parts (as shown above).



Left: A typical closed centre accumulator system. Oil flows from the reservoir to the pump through the check valve to the accumulator. Maximum pressure on the accumulator opens an unloading valve. The oil then circulates at reduced pressure to the reservoir. At minimum accumulator pressure the unloading valve resets, stopping circulation to the reservoir and starting the accumulator charging. Right: The three types of accumulator discussed below. They are (l to r), bag type, weighted plunger type and piston type.



Gas bag type



Weighted plunger type



Piston type

## Methods for storing hydraulic energy

These accumulators can save their energy like an electrical battery

**Herb Schmiel** PARKER-HANNIFIN CORP.

Like the familiar electrical storage battery the hydraulic accumulator stores energy (in this case, hydraulic energy) for use in performing work. This work can include the operation of cylinders and fluid motors, the maintaining of required system pressure in the event of a pump or power failure, compensation for pressure loss due to leakage, the supplementing of pump delivery to meet peak loads in excess of pump displacement, and many other jobs. Accumulators also can be employed as fluid dispensers, as fluid barriers and to provide a shock-absorbing (or cushioning action).

The accumulator's energy potential (or fluid pressure) is normally supplied initially by a pump. A big advantage, however, is that a small capacity pump (and a low horsepower pump-drive motor) can be used to

store a large volume of oil in the accumulator during a specific time interval, and this oil volume (if need be) can then be discharged into an operating cycle which is but a fraction of the storing cycle.

Until the advent of the modern piston-type accumulator, most accumulators were of either the bag or weighted plunger types.

In the **bag type** illustrated, air is precharged in a flexible bag, and oil (as it is forced into the accumulator shell by the pump) collapses the bag, thus reducing the air volume and increasing its pressure. This pressure, reacting against the oil, is then available to do work. The chief drawback of a bag type accumulator is bag fatigue. This difficulty is aggravated by extreme cold or heat, often environmental factors in many systems requiring accumulator units.

The **weighted plunger type** accumulator (which is usually a cylinder equipped with a weighted plunger) uses a fixed oil pressure reacting against the plunger, lifting it and providing the work potential. This work potential is available when the weighted plunger is allowed to descend into the cylinder, forcing the oil out.

Due to its weight and vertical positioning requirements this type of accumulator can normally only be used successfully for stationary installations in central power systems.

The modern **piston type** accumulator (specifically designed to answer the fatigue, weight and installation problems of its predecessors), uses a cylinder containing a floating piston having oil on one side and air (pre-charged) on the other. An increase in oil volume decreases the air volume and increases the air pressure, thus providing work potential when the oil is allowed to discharge.

Shock-absorbing action (where required) is provided by the air pressure on one side of the piston dampen-

Today's increased use of fluid power throughout industry and in the mobile equipment fields has brought many design engineers face-to-face for the first time with an extensive array of specialized fluid system components, among them the versatile hydraulic accumulator.

Although the basic operating principles of hydraulic accumulators have been understood and used in various forms for a good many years, it took the comparatively recent development of efficient lightweight, piston-type units to make hydraulic accumulators suitable for the wide variety of modern applications.

ing out surges in oil pressure acting against the opposite side of the piston.

Important advantages of today's piston-type accumulator units include: simple, compact design; dependable performance; sturdy construction; and maximum efficiency over a long service life. Wearing parts do not rupture, thus allowing higher working pressures with less buik. And maintenance is simple, because only the seals and piston guide rings need be replaced.

Accumulators, when incorporated in hydraulic systems of various types, normally permit a reduction in the cost, size, weight and complexity of the end product. In short, accumulators can do a job that would require a substantial amount of additional equipment (such as lines, pumps, valves and so on) if handled by some other method. And, as mentioned previously, a smaller displacement pump and lower horsepower drive motor can often be employed where an accumulator is used, thus making an additional portion of the total horsepower available for handling other jobs on a particular piece of equipment or in an industrial system.

Although the list of product applications for which modern piston-type accumulators are suitable is virtually endless, the following examples should suggest many possible uses, perhaps in your own equipment:

(1) On multiple operation machinery, accumulators are

now used to permit full pump flow to be employed for one operation, which accumulator flow is being used for others often at a different speed and pressure.

(2) On industrial lift trucks, accumulators are used to provide positive clamping action on heavy loads when pump flow is diverted to lifting or other operations. The accumulator also acts as a safety device to prevent the load from being dropped in case of an engine or pump failure, or fluid leak.

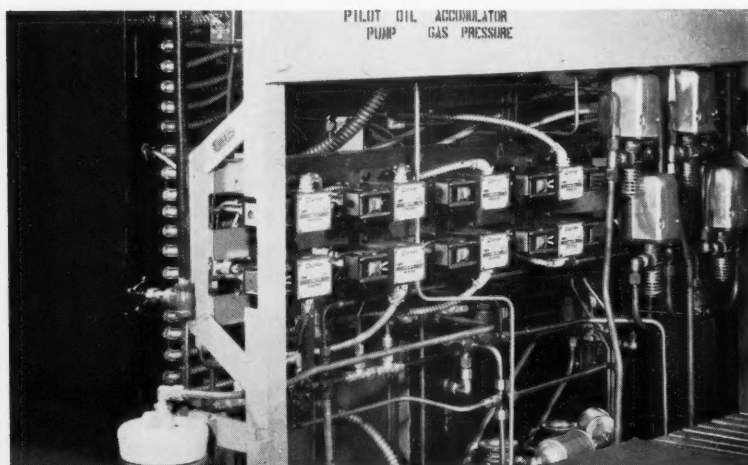
(3) Also on lift trucks and other mobile equipment (and on certain industrial machinery) accumulators absorb shock resulting from load starting, stopping or reversal, thereby protecting and prolonging the service life of valves and other expensive hydraulic system components.

(4) Accumulators are employed as a source of power in applications such as electrical circuit breakers and switchgear and for diesel engine hydraulic starter systems. In certain automotive applications, accumulators provide temporary hydraulic pressure for power-operated devices while the engine is stopped.

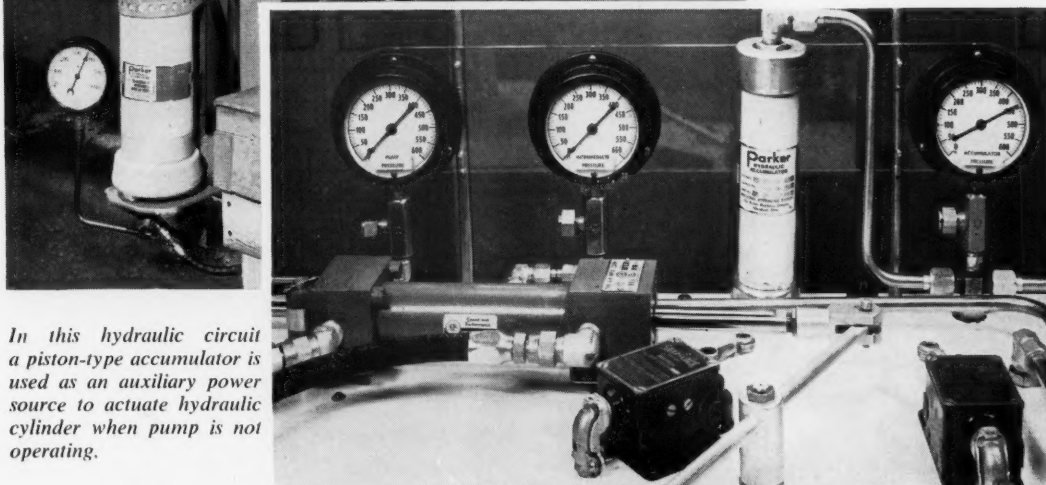
(5) In the braking systems of mobile equipment, accumulators are used in certain instances as a cushion, in order to provide soft but positive brake action.

(6) Accumulators also find application as fluid dispensers in industrial and mobile pressure lubrication.

Continued on page 73



*Piston-type accumulator (left) shown here installed on a typical production test stand, is used as a cushion to maintain steady pressure and dampen out pump surges in the pilot pressure line to the series of control valves on the stand.*



*In this hydraulic circuit a piston-type accumulator is used as an auxiliary power source to actuate hydraulic cylinder when pump is not operating.*



# The proposed standards for hydraulic symbols

This set of standards sets out to bring order out of diagram chaos

A drawing that depicts a hydraulic (or pneumatic) circuit for the control (or transmission) of power differs in many ways from most other engineering drawings. Explanatory notes and data are required in order to convey complete and proper information. The amount of information provided (and the type of diagram used) depends largely on its intended purpose, but it must satisfy the requirements of both supplier and user.

There are four types of diagram:

- (1) A **pictorial** diagram, used for quotation and piping the installation.
- (2) A **cutaway** diagram, most often used for instruction purposes.
- (3) A **graphical** diagram, used for quotation, piping the installation and for analyzing circuit operation. This type of diagram is gaining considerably in favor, for it readily provides information otherwise difficult to show, but necessary for circuit analysis. An example is shown in Fig 5.
- (4) A **combination** diagram, used to emphasize the purpose and operation of a portion of a system. Some details of the symbols used in these diagrams will now be given.

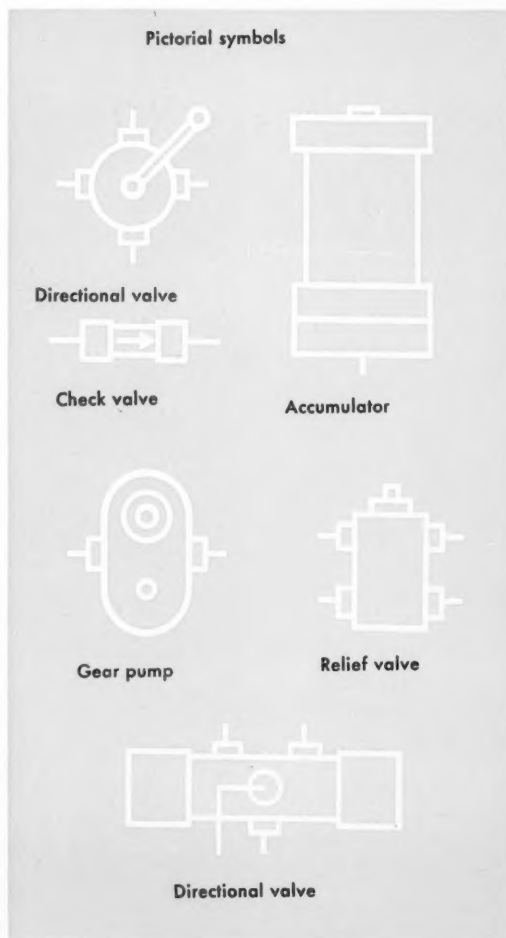
## Acknowledgement

This information is taken (by permission of the ASME) from the proposed standard for fluid power diagrams (Y-14 committee, subcommittee 17) and graphical symbols for fluid power diagrams (Y32). Both these reports are in the tentative stage but few, if any, changes are anticipated. For more complete information, the reader should refer to those reports.

## (1) Pictorial symbols

These are miniature drawings of various components. Symbols vary to agree with the appearance and purpose of the component, by simplifying one view of the manufacturer's installation drawing. The view that permits separation and emphasis of external ports and external controls should be used. Port and control locations may be distorted for added clarity. Sufficient detail is shown to permit easy identification. The entire symbol is usually drawn with a thick line. In the interest of some degree of uniformity, all components are drawn to indicate relative size. Typical examples appear in Fig 1.

Figure 1



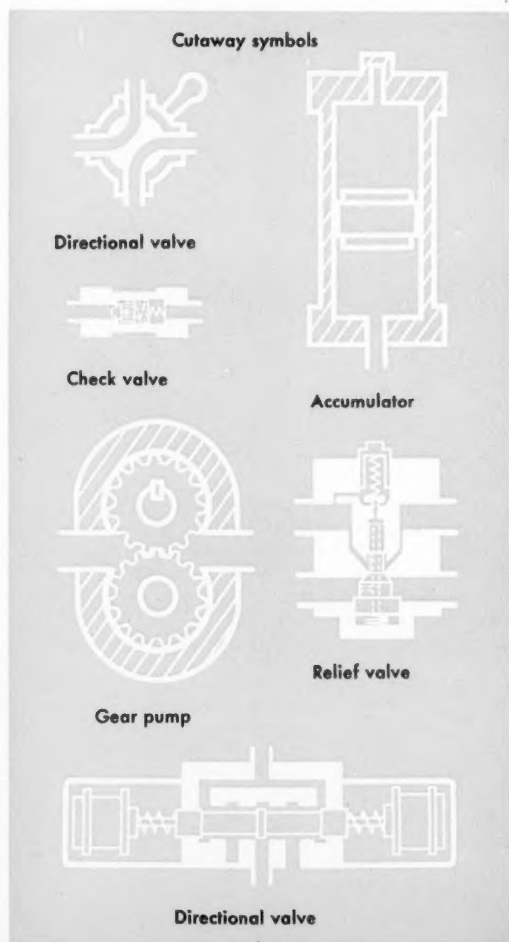




## (2) Cutaway symbols

Cutaway symbols consist of miniature section drawings. No standard exists for these symbols but each symbol should show all internal and external ports; clearly indicate flow paths; and show control elements (such as levers, springs and solenoids) needed to illustrate operation. The section or construction should be modified to clarify the function, changes made to eliminate features that are purely structural in nature and have no bearing on function. In addition, the diagram should show physical characteristics (to permit easy identification).

Figure 2

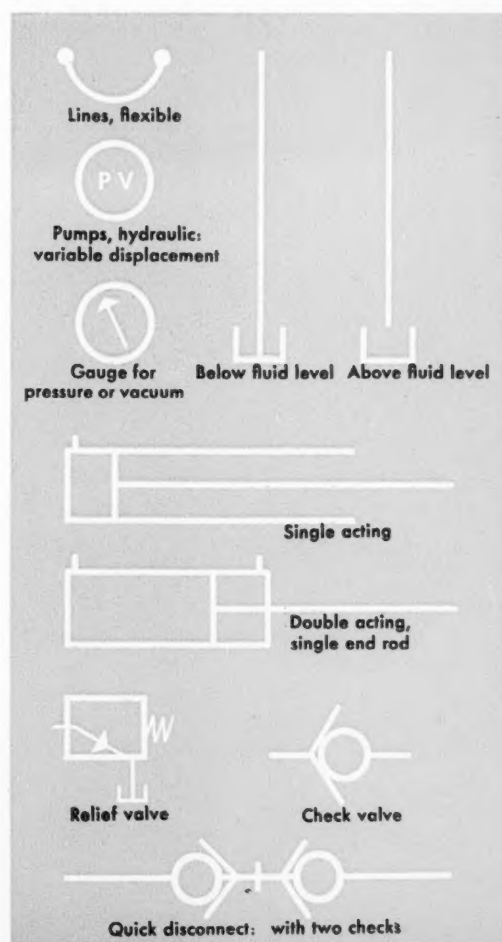


## (3) Graphical symbols

Graphical symbols are a combination of simple geometric figures indicating the function and nature of components. Composite symbols combine certain symbols to indicate the flow path and method of operation. Composite symbols may be further combined within an enclosure to depict an assembly. The entire symbol (except enclosure) is usually drawn with thick line width.

Fig 3 shows representative graphical symbols. As stated in (3), the graphical diagram is gaining considerably in favor. Full details appear in report Y32.

Figure 3



### Combination symbols

Pictorial cutaway or graphical symbols may be combined to emphasize a portion or feature of any assembly, as shown.

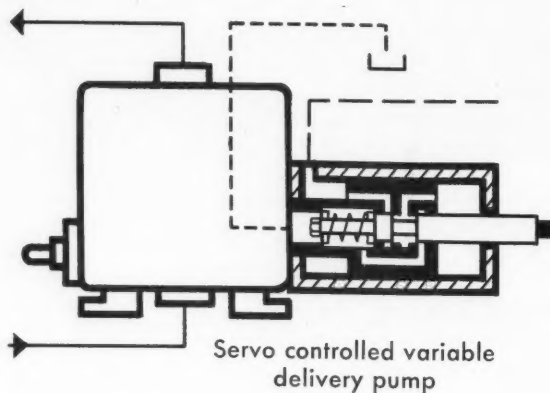


Figure 4

### Graphical circuit diagram

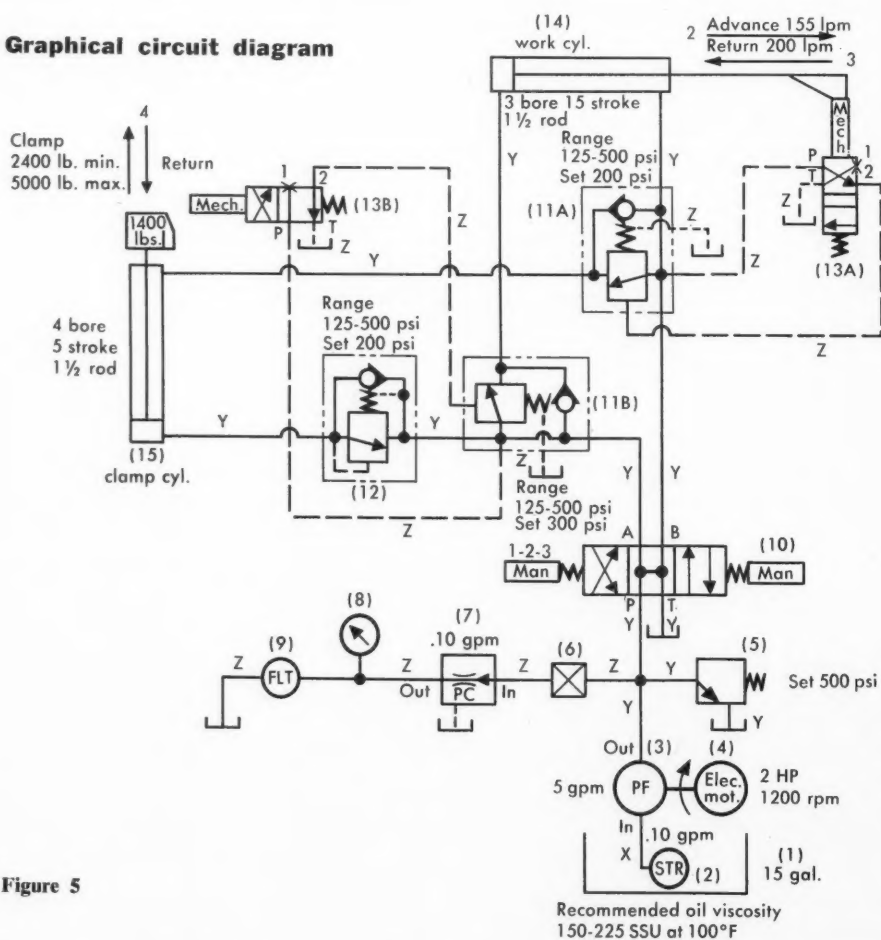
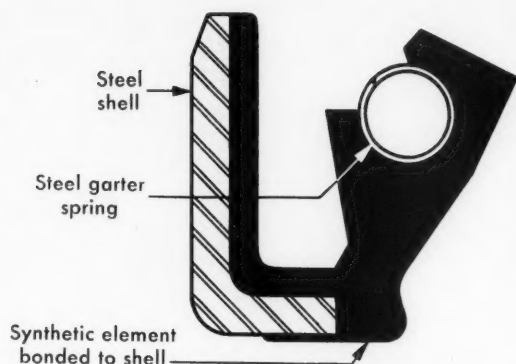


Figure 5

# Ideas round-up

## Oil seal: applications on heavy-duty machinery



The Garlock Packing Company recently introduced a newly designed, large-size Kloxure oil seal. The unit (Model 73-B) is intended for sealing applications on steel mill rolls and other large heavy-duty machinery. Sizes are available to fit shafts from 8 in. to 46 in. diameter.

The synthetic rubber sealing element is specially compounded to resist oils and greases, water, mild acids and alkalis. This non-porous, grainless rubber will withstand operating temperatures from 40 F to those in excess of 250 F. A variety of additional compounds (such as silicone rubber) is available for extreme service conditions.

As shown in the diagram, Model 73-B is fitted with a steel garter spring to ensure full and effective spring action at all times. (Stainless steel springs can be ordered for corrosive environments). The shell, to which the synthetic rubber sealing element is firmly bonded, is also of steel (or stainless steel) depending on the conditions. (210)

## Collimator: direct reading to within 1 sec of arc

One of the most difficult jobs in the workshop is the measurement of angles quickly and accurately. This problem has inspired the George Scherr Company to develop the Opto-Tooling-Auto-Collimator reading directly to 1 sec of arc. This collimator does away with the need for sine bars, tables of sines and the calculations previously necessary to establish angles. Testing the surface flatness of machine beds, checking the squareness of surfaces, measuring the alignment of centres, testing angles on jigs and fixtures, checking the straightness of bores, checking faces for parallelism, are just a few of the many difficult and delicate jobs it will do.

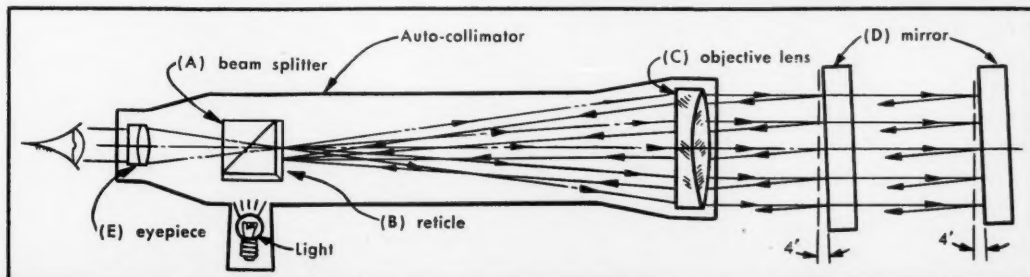
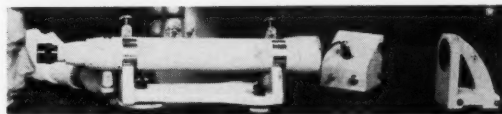
The instrument is a modified astronomical telescope with a focus permanently set at infinity.

Rays from the light source are reflected by a partially aluminized mirror (beam splitter) (A) and projected on and through the reticle (B). The rays of light emerging from the objective lens (C) contain the reticle crossline pattern and are projected in a bundle of parallel light rays. When this bundle of parallel rays falls

upon an optically flat first surface mirror (D) it is reflected back in a parallel bundle. The direction of the reflected rays is determined by the position of the reflecting surface of the mirror relative to the optical axis of the telescope.

Upon passing through the objective lens, each reflected ray is refocused back onto the reticle plane and produces an image of the original reticle. The observed position of the reflected reticle is determined by the amount of rotation to which the mirror has been subjected.

In observing the positions of the reticle, an eyepiece (E) is focused on the reticle plane. The focusing of the eyepiece is adjustable to each viewer's vision, to eliminate parallax when making observations. (211)



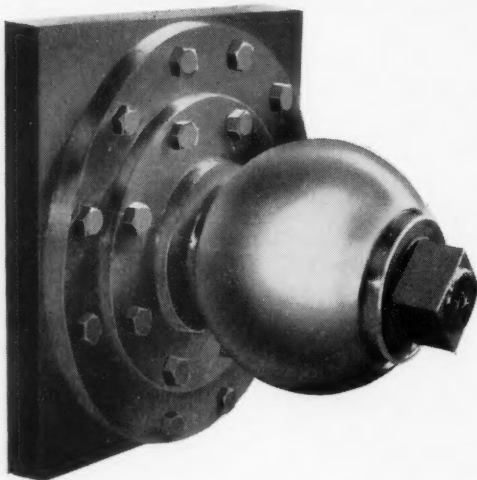
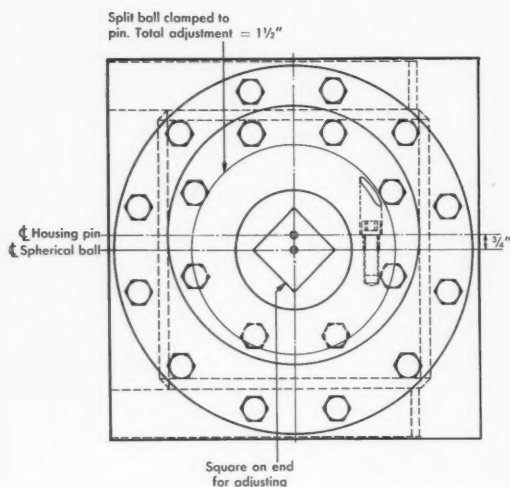
## Adjustable trunnions: movement in any direction

Details are shown of the adjustable trunnions designed by Riverside Iron and Engineering Works of Calgary for use with a Taintor gate.

The design of this unit was complicated by specifications calling for not less than  $1\frac{1}{2}$  in. adjustment in any direction. The special design involved a fixed trunnion sleeve and a machined eccentric sleeve and pin.

A flange on each of these components allows them to be fixed in any of twelve positions about the axis of the fixed sleeve, thus providing an eccentricity of  $1\frac{1}{2}$  in.

To permit up to  $1\frac{1}{2}$  in. longitudinal adjustment with split bronze bearings attached to the gate arms, spherical bearings, keyed and clamped to the trunnion shafts, were supplied. (212)



## Copper plating: any thickness can be obtained

Smooth surface copper plating to any thickness can be achieved with CuSOL, a new addition agent developed by The Seymour Manufacturing Company.

The CuSOL process eliminates the roughness, treeing and nodular build-up that occur in ordinary acid copper baths and thus make it particularly useful for electroformed molding operations. Since CuSOL's acid base does not affect the laminate boards, it can also be recommended for printed circuit manufacture.

The new addition agent is usable up to 15 days without replenishment in any normal cold or warm acid copper bath. The resulting fine grain copper deposit not only makes for smoothness and ductility, but ends flaking and cracking. A 0.030 in. CuSOL copper plate has the same ductility and elongation as 0.016 in. plating accomplished through ordinary acid copper solutions. Current density range is wide, from 5 asf to 280 asf.

The process makes for smooth, fine grain copper plating as in the 0.030 in. thick example (left). The 0.016 in. plate (right), deposited in an ordinary acid copper bath solution, reveals a rough, granular surface, with nodular build-up along the edges. (213)







## How filing a drawing can shorten its life

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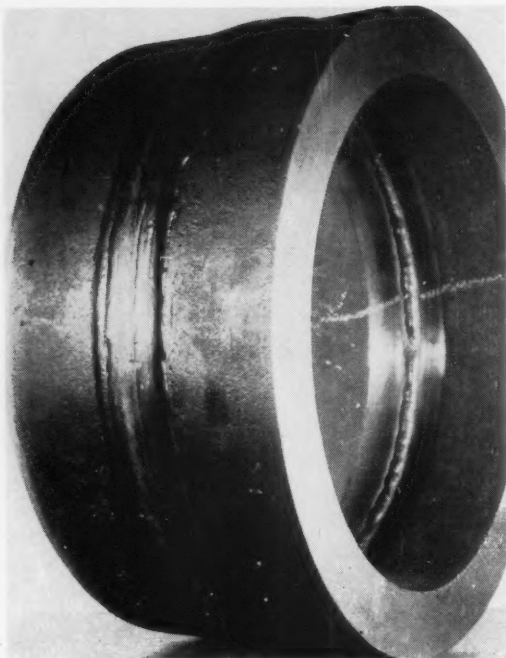
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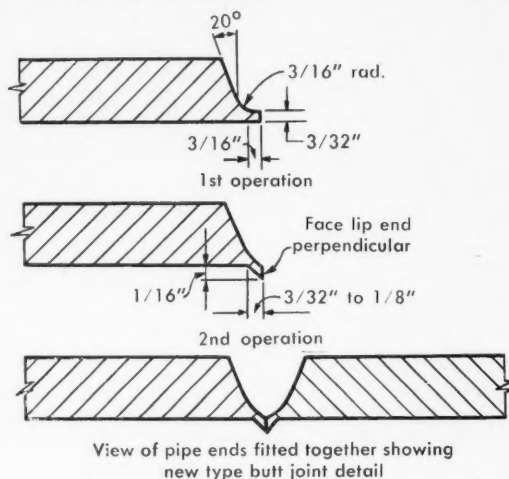
## Arc welding pressure pipe



An arc-welding process, that eliminates the need for metallic backing rings or inserts when welding butt joints in pressure piping systems, is being successfully applied by Stone & Webster Engineering Corporation.

In power, chemical, petroleum or nuclear installations (and in other applications where it is necessary to produce a uniform inside bead condition), this inert-gas-shielded welding procedure is used.

The main feature of the technique (which was developed by R. T. Pursell, their metallurgical engineer), is the novel way in which the root edges of the joint are prepared. They are in fact bent to produce an internal circumferential lip. When edges of this type are fused together in an inert gas atmosphere, the inevitable concave condition associated with fixed position yield welds is eliminated. (214)



A vibration system for obtaining high forces during high frequency vibration tests has been introduced by L.A.B. Corporation. This new vibrator (Type F-20) employs a simple hydraulic-mechanical system to produce forces up to 20,000 lb at frequencies up to 600 cps. Smoothness of wave form is achieved by a piston design that makes it possible to obtain acceleration levels up to 50 g. Electronics are not used in the system, thus minimizing maintenance and purchase cost, and confining operation only to frequency and force adjustments. The vibrator consists of three basic units: the vibration head, which has a moving element weighing only 20 lb, a hydraulic pump unit and a variable speed drive motor to control frequency. Total power consumption of the system does not exceed 50 hp.

Only two moving parts are used in the force-producing unit and all lubrication is self-contained. Gas charged accumulators are strategically located in the hydraulic system efficiently to utilize and store the energy produced by the pump unit, further minimizing power requirements. A centring device is included in the force piston mechanism allowing the vibration element automatically to find its neutral position, regardless of operating conditions. The piston is designed to carry loads up to 100 lb directly, without transmission linkages. Larger loads are independently suspended.

The large force available from this vibration system (as well as its low cost and lack of complexity) is said by the manufacturer to fill a long established need for high frequency vibration equipment. (215)

## Hydraulic vibrator: frequencies up to 600 cps



HERE'S ONE — MORE TO COME

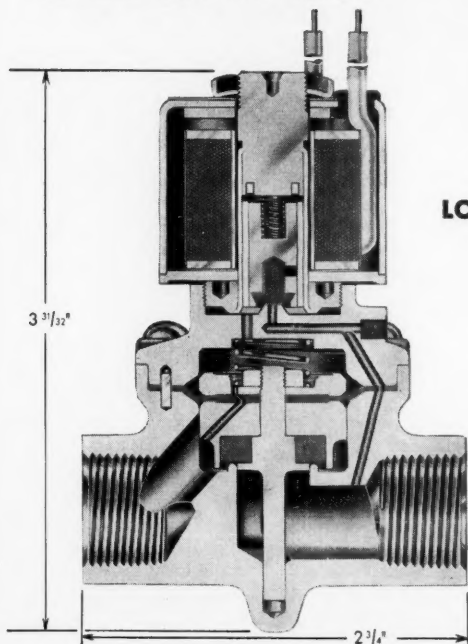
## New Skinner Valves at Low Prices

Here it is — one of the many new lines Skinner will bring you in 1958. A new 2-way, normally closed, pilot-operated valve that is lighter in weight — only 1 3/4 pounds — and smaller in size, yet permits full flow through a 1/2" orifice with 3/8" or 1/2" pipe taps.

The valve handles pressures from 5 psi to 150 psi, with temperature ranges from -40°F to 180°F, and will operate on all popular AC and DC voltages. It's small but rugged, economical but efficient — manufactured to the highest engineering standards of the Skinner Valve line.

Versatility is also a feature of the new Skinner L Series; modifications are already available for normally open operation, with such options as manual override, explosionproof construction and choice of electrical connections to fit your application requirements.

You can get full details of this exciting, new valve line by writing us direct or by contacting the Skinner Representative or Distributor near you. He's listed in the Yellow Pages. Write Dept. 353.



2-way normally closed  
shown actual size.

### LOOK AT THESE HIGH-QUALITY FEATURES:

- Unique Diaphragm Design — by actual test, this new design outperforms all others — the diaphragm is completely supported at all times. The nylon-reinforced buna diaphragm has a high resistance to media impurities, and only a small area is exposed to pressure, which assures long, trouble-free life.
- So Easy to Mount — so light in weight that it can economically mount directly to line.
- Operates upside down, sideways, in any position — strong spring action snaps valve shut — every time.
- Forged Brass Body — provides low porosity and dense metal structure for rugged application and no leakage.
- Low Wattage Consumption — coil consumes only 8 watts, considerably less than comparable valves.
- Soft, Synthetic Inserts — withstand constant opening and closing of pilot and main orifices — are long-wearing and provide absolute bubbletight operation.
- Internal Stainless Steel Parts — eliminate internal rusting, clogging or contamination.



THE CREST OF QUALITY

# SKINNER

**ELECTRIC VALVE  
DIVISION** NEW BRITAIN  
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# DYCON

A friendly DYCON Engineer or service representative will be happy to call on you to help you solve your Hydraulic and Control problems.

A large variety of products is carried in stock to meet your immediate requirements.

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*Engineers and Manufacturers Representatives  
Specializing in  
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## WE REPRESENT TOP QUALITY MANUFACTURERS OF

Hydraulic Pumps	Tube Fittings
Hydraulic Motors	Hose Assemblies
Hydraulic Cylinders	Filters
Hydraulic Direction Controls	Test Stands
Hydraulic Power Units	Cycle Controllers
Hydraulic Reservoirs	Temperature Regulators
Hydraulic Pressure Controls	Valves for Air, Gas, Oil & water to 6000 P.S.I.
Solenoid Controls	

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**DYCON LIMITED**

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TORONTO 14. CL. 9-8276

QUEBEC:

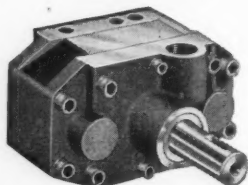
**COWPER COMPANY LTD.**

515 FOURTH AVE., LACHINE  
MONTREAL 32. ME. 7-6746

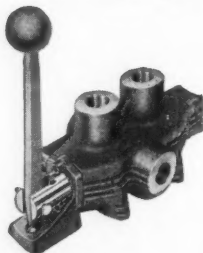


## HYDRAULICS — PUMPS, VALVES

GEAR AND VANE, PUMPS — CONTROL VALVES — RELIEF VALVES



**Gear Pumps**  
1000 P.S.I.  
8 and 12 G.P.M.  
Counter Clockwise—  
Max. 600 R.P.M.

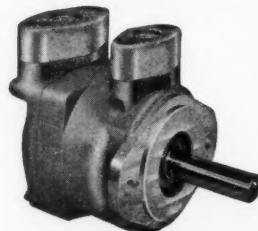


**Control Valves**  
3 Way (single acting)  
4 Way (double acting)  
1250 P.S.I.  
16 G.P.M.

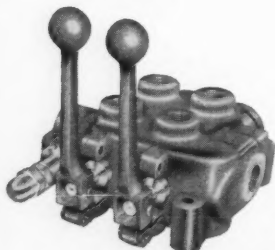


**Differential Relief Valve**  
7 G.P.M. at 15 ft/sec.  
24 G.P.M. at 15 ft/sec.

**Pressure Range**  
100 — 500 P.S.I.  
500 — 1250 P.S.I.  
1250 — 2500 P.S.I.



**Vane Pumps**  
**Specifications**  
1000 P.S.I.  
3-6-9-12-16-20-24 G.P.M.  
Max. 2000 R.P.M.  
**Rotation**  
Clockwise — Counter Clockwise  
**Mounting Feet Available**



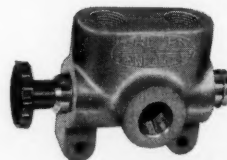
**S.P. Controls**  
Multiple Combinations  
Built-In Adjustable Relief Valve  
Reversible Handles  
Open Center — Closed Center  
Free Flow — Float Valves  
Available with Top, Bottom or  
Side Outlet. Also with Two Port  
Outlet for power beyond.

**SPECIFICATIONS**  
1250 P.S.I. — 20 G.P.M.  
For Parallel Application

Write for Catalog

**OTHER GRESEN  
PRODUCTS**

Float Position  
Valve  
Couplings



**Selector Valve**  
Openings — 1/2" NPT  
Openings — 3/4" NPT  
Openings — 1" NPT

**GRESEN MANUFACTURING COMPANY**

405-35TH AVENUE N.E.

MINNEAPOLIS 18, MINNESOTA



## New LENZ PRODUCTS



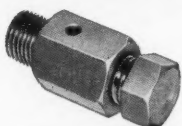
### PIPE FITTINGS

A complete line of connectors, elbows, crosses, tees, bushings, couplings, nipples and plugs... for every pipe need.



### HOSE FITTINGS

Perfectly matched hose assemblies... a full line of re-usable fittings and hose lengths in low, medium and high pressure ranges.



### AIR BLEEDER VALVES

Compact, functional... only two metal parts... no packings. Maintain maximum operating efficiency by eliminating air from lines.

A TOP  
NAME IN  
THE INDUSTRY

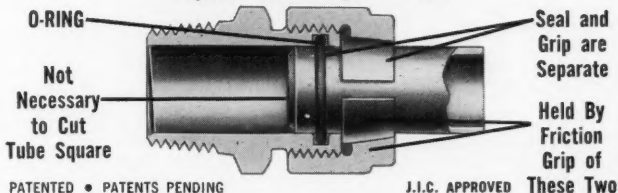


A Complete Line of Fittings  
and Connections for any Type  
of Piping Application...

## LENZ-O-RING

### TUBE FITTINGS

*Tapered or Straight Thread*



Lenz fittings seal with standard, stock O-Rings. At zero pressure the initial compression furnishes necessary sealing force... the higher the pressure the tighter the seal. Every joint becomes a union!

LENZ FITTINGS pay for themselves over and over again by reducing installation and maintenance costs... only a hack-saw and a file needed... no periodic tightening... remain leakproof and reusable no matter how often reassembled... Ideal for all tubing on hydraulic, air or vacuum systems.

Represented in Canada by

**DYCON LTD.**

Toronto, Ont.

**COWPER CO.**

Montreal 32, Que.

**TRIDEL EQUIPMENT**

LIMITED

Vancouver 5, B.C.

where tight closing is a "must"

... use

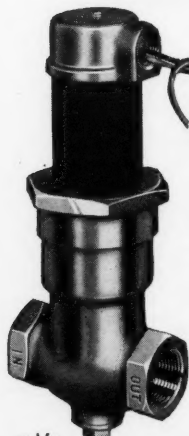
## Atkomatic SOLENOID VALVES



guaranteed

LEAK PROOF

BUBBLE-TIGHT



send for  
FREE 20-pg. cat. No. 200.

You're sure of leak proof valve performance with Atkomatic. Atkomatic Solenoid Valves have a specially designed resilient pilot seat and main disc which eliminates metal-to-metal seal when the valve is closed. This pilot seat is available on request at no extra charge. The result is an absolutely bubble-tight seal... and Atkomatic guarantees it! Atkomatic offers a complete line of solenoid valves for air, gas, liquids and steam. Bronze or stainless steel. Pressures from zero to 5000 psi. Orifice sizes from  $\frac{1}{16}$ " to 3".

**ATKOMATIC VALVE CO., INC.**

Dept. 2A  
545 W. Abbott Street  
Indianapolis, Indiana

SPECIFY

**SINCLAIR-COLLINS**

DIAPHRAGM-OPERATED  
CONTROL VALVES



6000 PSI—Balanced  
3 Way Valve



4000 PSI—Balanced  
3 Way Valve



4000 PSI—2 Pressure,  
Hydraulic Operating  
Valve—Automatic  
High Pressure



4000 PSI—2 Way  
Valve—Direct  
Acting—Normally  
Open Type



3000 PSI—4 Way  
Hydraulic Valves

for push button  
automatic control...  
trouble free  
service!

2, 3 and 4 way,  $\frac{1}{2}$  to 3 in.  
single or two pressure  
high or low pressure—air operated,  
oil operated—for air, steam, hot  
or cold water service—remote manual  
or automated control.

Any heavy duty processing equipment you manufacture or operate will perform better—at lower cost—with Sinclair-Collins valves!

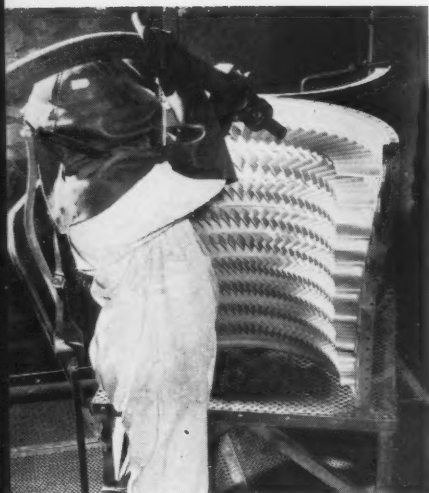
Shockless pressure control, Stellite valve stem seats, replaceable hardened stainless steel seat sleeves, cast navy bronze or bronze alloy billet stock valve bodies... these are Sinclair-Collins features.

For all your valve needs, delivered from stock, consult your Sinclair-Collins representative. AA-4971

Representatives in principal cities

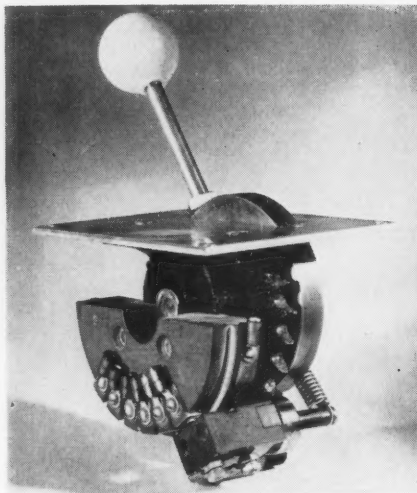
**THE SINCLAIR-COLLINS VALVE COMPANY**  
454 Morgan Avenue, Akron 11, Ohio

## Design news in pictures



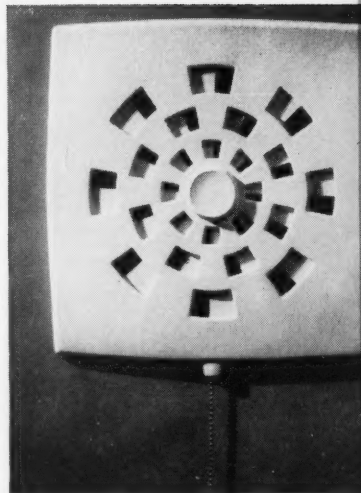
**Walnut shells and rice**

Not a new idea but an interesting one nevertheless is to be found in this technique for blast cleaning used by Orenda. The machine's shot is of walnut shells and rice. (200)



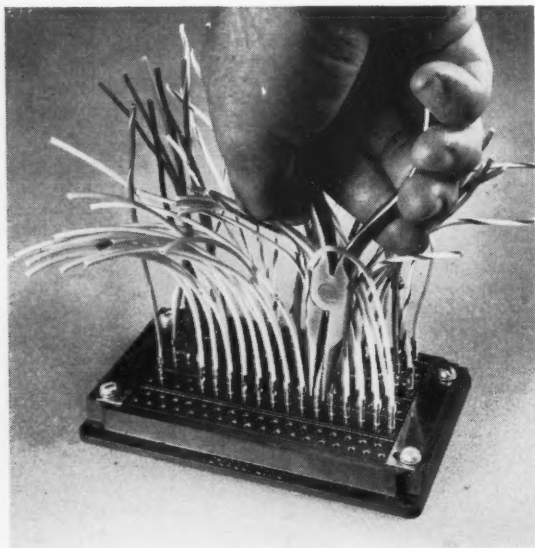
**Features self-wiping**

Originally developed for use in sawmill networks controls, this selector switch eliminates dial turning and button pushing. Self-wiping guarantees long life. (201)



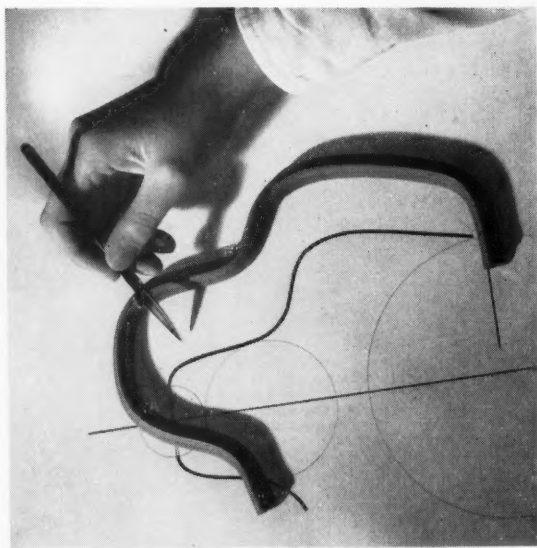
**Ventilator face**

Approximately a foot square, this attractive ventilator from Britain is made of thermosetting plastics, phenolic and urea, and is available in several bright colors. (202)



**For a missile launcher**

Developed for a missile launcher's electronic system, this panel assembly offers unusual circuit connection flexibility. Cables terminated with these taper pins are too inserted into panels, as many as eight panels in each frame. (203)



**Short cut to smooth curves**

This flexible ruler, triangular in section, is made from extruded plastic and has slightly concave surfaces between the edges which flatten out under pressure and keep it in any position on the drawing. Lengths to 5 ft. (204)



#### Putting the hush on jets

*These multi-tube noise suppressors have been installed on a Boeing 707 jet transport. They reduce sound level within aircraft as well as without. A round of applause for Boeing. (205)*



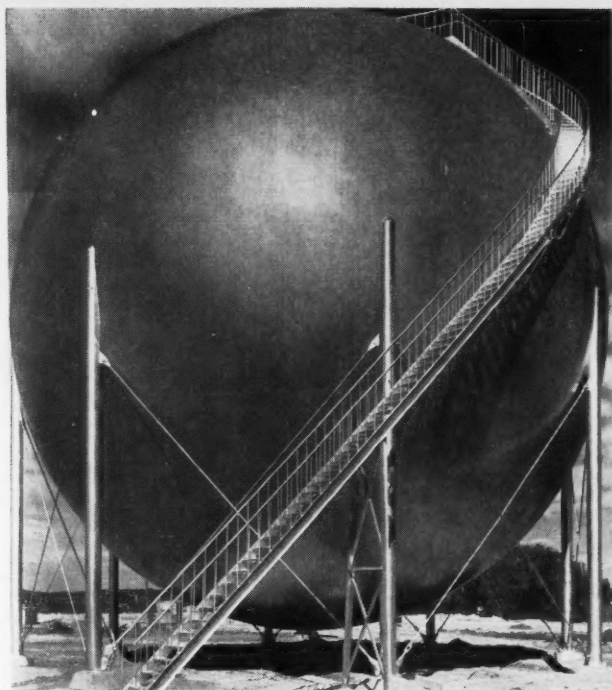
#### From 'Hi' to 'Simmer'

*Designed to fit 95% of all range openings are these "Microtube" units. They have high speed cooking power, plus a delicate response that finely controls through the heat range. (207)*



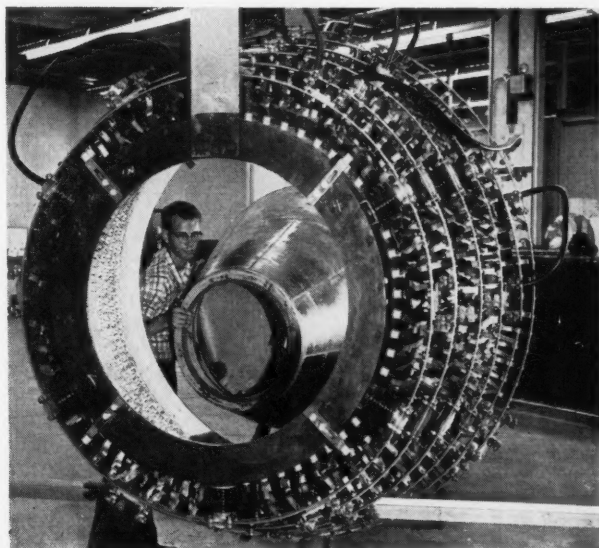
#### Pumping—tennis balls?

*Anything that can enter the intake will pass through this pump. The impeller is recessed completely and the pumping action is gentle enough to handle even fragile objects. (208)*



#### Giant silver ball

*New landmark on Toronto's eastern waterfront is this 60 ft. dia. sphere for the storage of sewage gases. These gases (a mixture of the lighter hydrocarbons) will be used for drying sludge and for heating buildings. (206)*



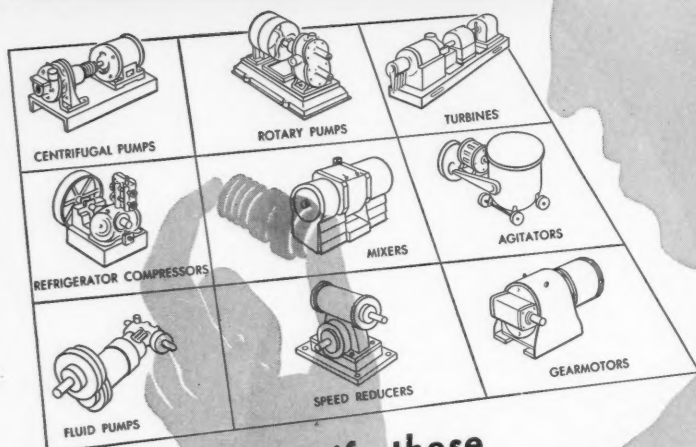
#### Missile 'super toaster'

*In order to duplicate the severe temperature conditions encountered when a ballistic missile re-enters the atmosphere, this oven was built. Quartz heating lamps do the work. Some useless information — it gives enough heat to toast 7,000 slices. (209)*



**YOU insure**

**RUGGED FIELD PERFORMANCE  
plus PRODUCTION SAVINGS**



when you specify these

**JOHN CRANE**

**MECHANICAL  
SEALS**

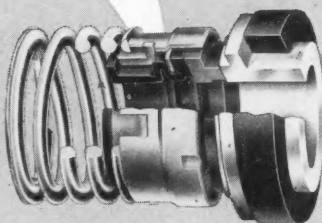
"JOHN CRANE" Types 1 and 2 shaft seals come pre-assembled. They are quickly and easily installed. Tolerances need not be critical due to the self-adjusting seal head. This is accomplished through special construction of the synthetic rubber bellows head. Moving freely under spring and hydraulic pressure, it automatically compensates for shaft end play, as well as washer wear.

Sealing faces are precision-lapped to prevent stuffing box leakage. No break-in runs necessary. Positive drive feature eliminates all stress on bellows. This feature also permits the use of light spring load to minimize wear on sealing faces. Seal needs no attention over long periods of operation.

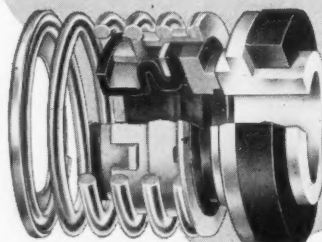
Recommended for water, oil and other services non-injurious to synthetic rubber. Pressures to 200 psi. Temperatures: -40° to +212°F.

Write for Bulletin S-213-1

Crane Packing Co. Ltd., 631 Parkdale Ave. N., Hamilton, Ont.



Type 1. For stuffing boxes of limited diameter.



Type 2. For stuffing boxes of limited length.

Above seals also available in balanced construction (1-B, 2-B) for pressures up to 500 psi.

**JOHN CRANE**

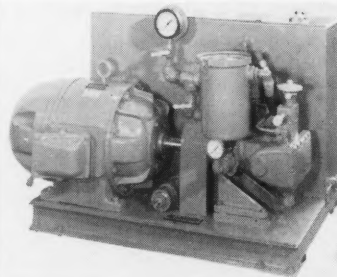
**CRANE PACKING COMPANY**



## New Products

### Power units

Details are given, in an illustrated leaflet from **Rousseau Controls Ltd.**, of their hydraulic power units designed to meet specifications set forth by the Joint Industry Conference (JIC) of hydraulic standards for industrial equipment. The base of the unit is of welded steel chan-



nel and angle construction. The reservoir and the pump motor assembly are mounted side by side on this base. This design is superior to the old-fashioned models, where all the equipment was mounted on top of the reservoir. (216)

### Lubricant-additive

A concentrated (1 to 1,000) lubricant and rust-preventive for water-actuated hydraulic systems is now supplied in bactericidal form.

The bactericidal agent "drastically retards" the growth of odor-producing organisms, reports **E. F. Houghton & Co.**, suppliers of Hydrolubric. It also minimizes the slime that can clog filters and screens and so reduces maintenance costs and extends the life of components.

Not to be considered a cure-all for cleaning dirty and bacteria-laden systems, the bactericide will keep a reasonably clean system free of odor and slime while the Hydrolubric does its primary work of lubricating the system. (217)

### Silicone rubber

Announced as a new material for O-rings and custom molded parts for high temperature sealing applications: silicone rubber compound number 85-138 (**Parker Hannifin Corporation**). The compound is recommended for temperatures as high as 600°F for short periods. It has a Shore A hardness of 50 degrees, about 800 psi tensile strength and about 250% elongation.

Compression set after 24 hr at 450°F is approximately 25% by thickness. After air-aging at 600°F for 48 hr, tensile loss is about 35%, elongation is 59% and hardness increase 15 deg Shore A. (218)

Continued on page 70



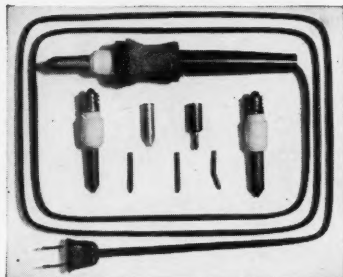


# NORANDA COPPER AND BRASS LIMITED

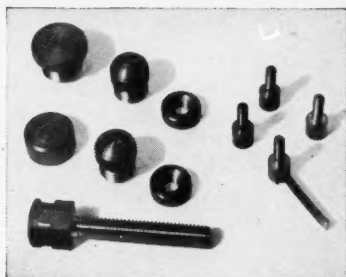
## COPPER ALLOY BULLETIN



MILLS AT MONTREAL EAST—OFFICES IN MONTREAL, TORONTO, WINDSOR, EDMONTON, VANCOUVER  
Export Department, P. O. Box 1238 Place D'Armes, Montreal, P.Q., Canada



New lightweight soldering pencil uses Noranda Tellurium Copper tips for easier machining, faster and more uniform heating. (Courtesy, Ungar Electric Tool Co. of Canada, Toronto)



Noranda Tellurium Copper gives machining qualities of free-cutting brass, performance of pure copper to these screw-machined parts.

### Noranda Tellurium Copper Offers High Conductivity Plus Machinability

Copper made the practical use of electricity possible. It has always been specified by engineers for the manufacture of components for the electrical industry. New applications are still being found to make use of copper's high electrical and thermal conductivity.

Noranda's research facilities are engaged in a constant search for new materials to satisfy the demands of Canada's expanding industries. For instance, manufacturers of electrical components have been looking for a material that combines the conductivity of copper with the machinability of free-cutting brass. In the past, attempts at alloying copper with various elements have produced a harder material without reducing its characteristic toughness.

In Noranda Tellurium Copper we feel we have the answer. Our engineers have found that the addition of a very small amount of Tellurium to copper raises its machinability from 20% of free-cutting brass to 90%. This is accomplished with negligible effect on its other desired properties.

Using Noranda Tellurium Copper, manufacturers of electrical components can increase screw-machine surface speeds up to four times faster than those recommended for pure copper. Tooling required to work Noranda Tellurium Copper is the same as that used on free-cutting brass.

Noranda Tellurium Copper may be extensively hot forged and, although its

ductility is slightly lower than that of pure copper, it can be readily cold worked. All these advantages are gained with electrical and thermal conductivities remaining almost as high as those of pure copper.

#### Applications

Ungar Electric Tool Co. of Canada, Toronto, uses Noranda Tellurium Copper for tips for their versatile, lightweight electrical soldering pencil for hobby and production line work. A number of interchangeable tips of different sizes and shapes are made from 1/8", 5/16", and 3/8" round Noranda Tellurium Copper rod. Complicated drilling and tapping operations take full advantage of its excellent machinability.

Noranda Tellurium Copper was chosen for other reasons, too. Its high thermal conductivity gives uniform heat at the pencil's tip. It tins more readily than other metals and it is less subject to oxidation. These tips heat to 600° F in 90 seconds.

The second application shown is a series of parts for use in the electrical switchgear industry. These were machined from 3/8" to 1-1/4" round, hexagonal and square Noranda Tellurium Copper rod.

The third example is a holder for a current-carrying bimetal contact. Electrolytic Copper was first specified for this part. Its machining characteristics made the important slotting operation

difficult. The problem was solved by using Noranda Tellurium Copper.

#### Noranda Research and Service

Tellurium Copper is just one of the many copper-base alloys produced by Noranda to solve specific problems. Each is the result of extensive research and development conducted by the Noranda Laboratory in close cooperation with fabricators and users in terms of their requirements.

Noranda Tellurium Copper, or one of the many other engineered Noranda alloys, may well be the answer to your particular problem. Our Technical Service Department and Laboratory will be glad to work with you on the application of these metals to your products. Contact your nearest Noranda Sales Office for immediate service. (2547)

### Chemical & Physical Properties of Noranda Tellurium Copper

ANALYSIS	
Copper %	99.5
Tellurium %	0.5
MECHANICAL PROPERTIES (rod 1-in. dia.)	
Ten. Strength, psi	{ Hard 48,000 Half Hard 42,000
Yld. Strength, psi (1/2" extension)	{ Hard 46,000 Half Hard 39,000
Elong. % (2-in.)	{ Hard 20 Half Hard 35
Rockwell Hardness	{ Hard B50 Half Hard B45
PHYSICAL CONSTANTS	
Specific Gravity	8.94
Density, lb/cu. in.	0.323
Elec. Conductivity, % (IACS at 68 F)	90.0
Thermal Conductivity (Btu/sq ft/ft/hr/F at 68 F)	205
Mod. of Elas. (Ten.) 10 <sup>6</sup> psi	17
Coef. of Ther. Exp. (per °F, from 68-570 F) x 10 <sup>6</sup>	9.8
FABRICATING PROPERTIES	
Machinability rating	90
Cold working	Good
Hot working	Excellent
Hot working range °F	1400-1600
Comm. anneal range, °F	700-1200
JOINING PROPERTIES	
Soft soldering	Excellent
Brazing	Good
Inert-Gas Arc Welding	Good

## New Products

*Continued*

### Flowmeter

A magnetic flowmeter that accurately measures the flow rate of "difficult" liquids (such as acids and slurries) without adverse effects on the meter is announced by **Fischer & Porter Co.** Major features are: manual adjustment for setting any desired flow rate at full scale. (For example the 1 in. meter can be set to handle from 3 to 40 gpm at full scale;

the ½ in. meter as low as 1 gpm); unrestricted flow readings unaffected by velocity profile, density or viscosity; voltage changes between 90 and 125 volts and frequency changes between 55 and 65 cycles have no effect on readings; special piping for long metering runs is not required; flow can be measured in either direction. (219)

### Reducing valve

All Type B pressure reducing valves made by the **Atlas Valve Co.** are now being supplied with a stellited main valve at no increase in price. This feature is in addition to the stellited pilot valve and

stellited pilot valve seat already supplied in the valve.

The valve is a spring-loaded, piston-operated type actuated by an internal pilot. Single-seated, tight-closing and completely self-contained, it is designed for inlet pressures up to 1,500 psi at 900 F. It will reduce to pressures as low as ½ psi in one stage.

Within the line, various models are available in ½ in. to 6 in. sizes, screwed or flanged ends and bronze, cast iron or steel bodies and with stainless steel or special alloy trim. (220)



### Air gun

Announced by **Simcoe Company** are two new types of static eliminating equipment, specifically designed for cleaning dust and dirt from plastic parts, plastic and paper sheets and films, textile materials, rubber, leather and all other types of surface to which the dust is being attracted and held electrostatically. In the new static bars, provision is made for simultaneously blowing off the dirt and neutralizing the static charges on both the dirt and the part being cleaned. This simultaneous action is much more effective than other cleaning methods (such as brushing or wiping), for not only is the dust completely removed, but the electrostatic forces tending to re-attract it to the part are eliminated.

One of the new static bars (the Air Type shockless bar) incorporates an air tube with holes opposite each point: it can be made in any length to fit the application. The other, called the Neutrostat air gun, is a hand-held compressed air gun with a static eliminator built into the nozzle. A small power pack, operated from an a-c service, will energize a number of the shockless bars or the air guns.

Some typical applications are: the neutralizing and cleaning of magnetic tapes before windup; plastic parts after molding; leather after brushing; lenses and optical surfaces ahead of assembly in sealed units; vinyl sheets before printing or silk screening; vials and containers before filling; masonite wallboard after sanding and grooving; and surfaces of various types before painting. (221)

**Continued on page 80**

FOR ANY TYPE — ANY SIZE

BALL AND ROLLER  
**BEARINGS**  
AND PILLOW BLOCKS

*You can depend on*

**R&M BEARINGS CANADA LTD.**

VANCOUVER WINNIPEG LONDON HAMILTON  
TORONTO MONTREAL THREE RIVERS QUEBEC CITY

**R&M**

**NEW DEPARTURE**

**OILITE**

**HYATT**

**HEIM**

**SHAFFER**

**CARBOLUBE**

**KAYDON**

**TIMKEN**

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*Catalogues free on request.*

**Stock deliveries.**

**Service across Canada.**

## Abstracts

### Hydraulic data

A bulletin containing hydraulic tables and other engineering data to aid hydraulic engineers and designers has been published by Baldwin-Lima-Hamilton Corporation.

The 40-page bulletin (No. 3300) describes and illustrates the range of Hamilton presses for producing laminated plastics, pressing dry ice, die hobbing, preforming and plastics and metal-powder compacting.

The bulletin furnishes conversion tables, decimal equivalents, hydraulic ram capacities, wire and sheet metal gauges, steel pipe tables, bolt tables, specific gravities and material strengths.

It also provides data on fluid losses, properties of metal sections, beam formulae, methods for finding moments of inertia of various sections, deflection curves for springs, temperature conversion tables and hardness conversion tables.

A discussion on water hammer and shock valves and information on accumulators, pumps and intensifiers also are presented.

### Integral seal ball bearings

The expanding use of "lubricated-for-life" integral seal ball bearings has resulted from the important savings and product improvements they have made possible. To take advantage of these improvements, the designer needs to be acquainted with the capabilities and limitations of each basic type of integral seal. A comparative seal evaluation (based on the standardized laboratory procedures employed by New Departure Division in evaluating seal and seal materials) is helpful for this purpose. This includes information concerning the effects which operational factors (such as temperature and speed) have on the grease life of sealed bearings. A study of the actual applications reveals the many different ways in which integral seal bearings are employed, and two factors stand out: design simplification and absence of maintenance requirements. In preparation for future needs, current trends must be observed and employed to guide future seal development. (from General Motors Engineering Journal, Aug. 1957, by Monich and Bragdon)

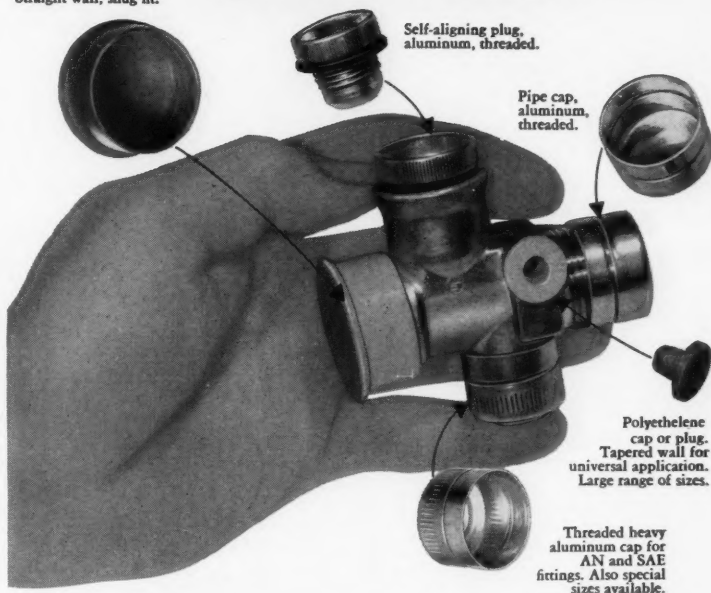
### Pullshovels

In the February issue, we omitted to state that this item was by R. A. Beggs, P.Eng. from the Dominion Engineer. We apologize.

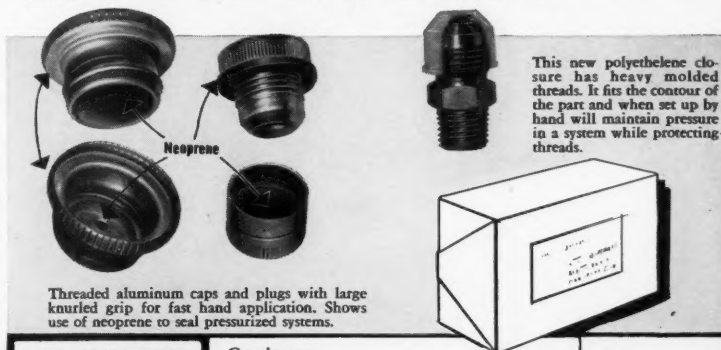
# These PLUGS & CAPS are easily hand tightened

For • Pressure Seal  
• Thread Protection  
• Moisture Protection

Polyethylene cap.  
Straight wall, snug fit.



When you buy Clover Closures you buy the best in tight fitting protection. They are made in polyethylene and metal for internal and external applications. Tight fitting design, seals out moisture, dirt and gives dependable thread protection. Metal closures with neoprene rings or discs can be used to seal unit and hold relatively high pressures. For the newest in closures always specify CLOVER! Special closures engineered to your requirements.



**CLOVER**  
Industries, Inc.



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TONAWANDA,  
NEW YORK

Gentlemen:  
Please send your idea box of  
Clover Closures.

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Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ Prov. \_\_\_\_\_

I am interested in:

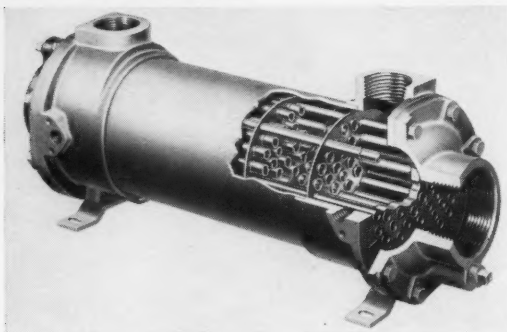
Plugs  
Caps  
In Metal  
In Plastic  
With Neoprene  
seal

Thd. Size \_\_\_\_\_

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## Heat exchangers



An expanded line of Type BCF heat exchangers (with improved performance, new design features and new materials) is now available at lower prices, announces Ross Heat Exchanger Division of American-Standard.

Designed for cooling lube oil, jacket water, hydraulic and other fluids (as well as many process heating applications), it is offered in 46 sizes; one, two and four pass designs; and 1.2 to 124 sq ft of heat transfer surface.

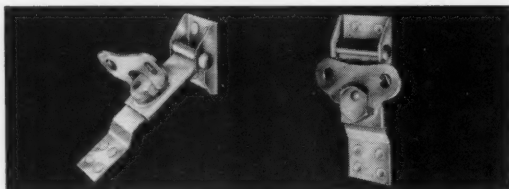
Improvements include: a new baffle structure with flanged lip at each tube hole and around the outer edge to give a tighter tube fit and improved thermal characteristics; stamped steel feet movable in three positions around the hubs for easy, more adaptable mounting; hubs relieved under connections for unrestricted flow; corrosion resistant copper alloy core assembly and rugged cast iron bonnets. (222)

## Hinge lock: secured by half a turn on a wing nut

The new Simmons Fastener Corporation hinge-lock is a high-strength pressure hinge providing a means of applying pressure along the hinge-line of hinged-cover containers and equipment cases.

Particularly useful for commercial containers and military cases of various types (such as rigidly specified instrument containers and pressure-tight shipping cases) Hinge-Lock insures a pressure-tight seal where gasketing is used. It is springless, impact and drop-resistant, and unaffected by Arctic temperatures. Positive hand locking is accomplished by a half-turn on the wing-nut. When pressure is released by a counter-turn, the hinge becomes free-operating.

Produced in two sizes (No. 2, medium duty and No. 3, light duty) it provides matched hardware when used with Simmons Link-Lock fasteners of the same



sizes. They both lie flat, and engagement latch details can be varied to suit different conditions. The actuating wing-nuts can be replaced by a bolt or screwhead.

Shown on the left: the No. 2 medium duty Hinge-Lock, closed, with sealing pressure applied. On the right, the same, open. (223)

## Low voltage circuit breakers

Major operating and maintenance innovations of its new K-line equipment (claimed as the most sweeping circuit breaker and switchgear advance in 13 years) are featured in a new bulletin published by I-T-E Circuit Breaker Company.

This bulletin (No. 6004-C) provides a complete review of their low-voltage power circuit breakers and switchboards, ranging in unit ratings from 225 to 4,000 amps.

Advanced features of the new K-line breakers (rated at 225, 600 and 1,600 amps) are described and illustrated in detail. Innovations include quick-make manual closure, pull-down handle actuation and simplification

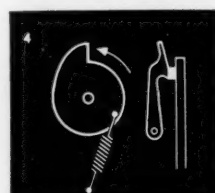
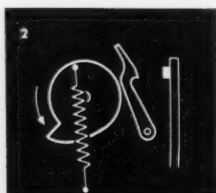
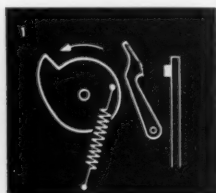
of trip unit continuous-current ratings.

Construction advances, such as closed-door drawout, unitized assembly and increased accessibility of trip units, are also detailed.

Application tables provide complete breaker ratings, control power requirements and ranges of overcurrent trip devices.

Basic information on low-voltage power circuit breakers is also included in the new bulletin. A review of the three principal system types (fully rated, cascade and selective) aids in the selection of the proper breakers for low-voltage drawout switch gear applications.

The simplified sketches show how the mechanism operates: (1) Energy is being stored in heavy springs; (2) the crossover point, springs release energy; (3) cam closes contacts (4) contacts are closed. (224)



Continued on page 76



## Seals for engines

(Continued from page 44)

as the speed reaches a predetermined higher value. It appears that the Germans at Peenemunde used this type of seal in their high-speed centrifugal pumps, where great difficulties were then (and still are) encountered in sealing a high-speed shaft when supported on ball bearings. The average ball bearing at high speeds is very rough and is not compatible with radial contact seals on the same shaft.

Although a neat solution to the sealing problem (where rotational speeds are high), the seal has a serious endurance limitation, due to the heat generated in the stalled centrifugal pump used to produce the pressure balance. The main application of this sealing technique will therefore be found in pumps for rocket motors and in afterburner fuel pumps for gas turbine engines, where the operational periods are relatively short. ★

## Hydraulic accumulators

(Continued from page 55)

(7) Where two different fluids are used in the same system, an accumulator can function as a fluid barrier, provided the accumulator's seal compound is suitable for both fluids. The application of an accumulator to perform a specific job in a specific system usually requires the talents of a competent hydraulic engineer, if an efficient design installation is to result. Determinations must be made, for example, of the best means of automatically keeping the oil reserve available within a maximum-minimum pressure range, the best method of metering oil out of the accumulator at the desired rate of flow, and the selection of the correct accumulator capacity to meet system requirements.

This is how you can get a general idea of the correct accumulator capacity. If the air precharge is the same as the minimum operating pressure, and oil is pumped into the accumulator until the air pressure is double the precharge, the total volume of the accumulator would be double the required amount of oil for this operation. To this capacity must be added a safety factor, and the air precharge pressure should be at least 10% below the minimum operating pressure to allow the accumulator to operate over the full required oil pressure range without the piston bottoming. ★

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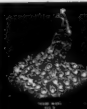
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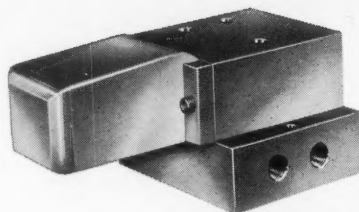
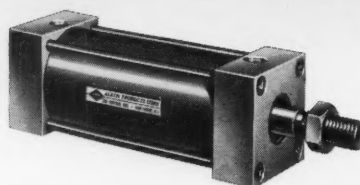
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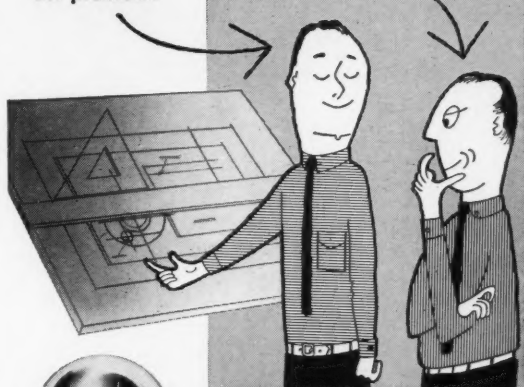
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## Brush holder: it simplifies electric motor building

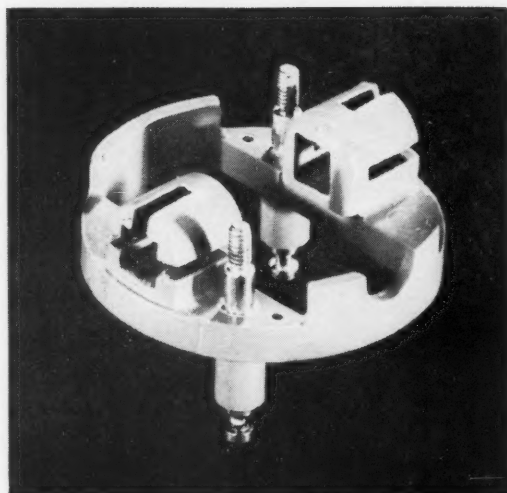
A brush holder, molded (by Gaylord Plastics, Inc.) of Plaskon Alkyd 440A, simplifies the building of miniature electric motors (for American Electronics, Inc.) by replacing a complicated assembly with a single, time-saving unit.

The compact one-piece brush holder (which fits over the commutator end of the motor) incorporates brush guides and molded-in contact terminals. These terminals also serve as supports for torque springs which operate through slots, applying pressure against the brushes, which in turn contact the commutator.

Thus the brush holder is designed to take advantage of alkyd's electrical insulating characteristics as well as its structural strength and dimensional stability. The reinforced plastic replaces a combination of materials in this application to simplify a formerly time-consuming assembly.

The material has an impact strength of more than 8 ft lb per in. notch (Izod). It is further characterized by improved arc resistance and is self extinguishing.

(225)



## Leveling mechanism: elevator stops within 1/4 in. of floor



*The unit is designed specifically for oil-hydraulic elevators and is constructed so that any piece can be removed easily or replaced by interchangeable parts.*

A mechanism which is the first to be included as an integral part of an oil-hydraulic control mechanism with unitized construction has been announced by Rotary Lift Company Division of Dover Corporation.

It is a two-way leveling mechanism wherein a combination of oil valves operates within one housing to control the movements of an oil-hydraulic elevator. Before unitized construction was developed, it was common practice to assemble an oil control system by taking a series of general purpose valves and connecting them with piping.

The two-way leveling feature causes an elevator traveling upward (or downward) to decelerate at a given distance before reaching a floor level. The elevator then moves to a smooth and accurate stop within 1/4 in. of the landing level. Earlier leveling operations required the elevator to pass a landing by several inches, stop and then return to the landing level.

The company states that the new valve is unaffected by extreme variance in internal oil line pressure caused by very light or heavy loads on the elevator platform. The two-way leveling oil control mechanism was formerly very sensitive to pressure change. Thus, when a very light (or very heavy) load was placed on the platform, the elevator might stop above or below floor level. This new valve assures accurate stops within 1/4 in. of floor level, regardless of the load on the platform.

(226)



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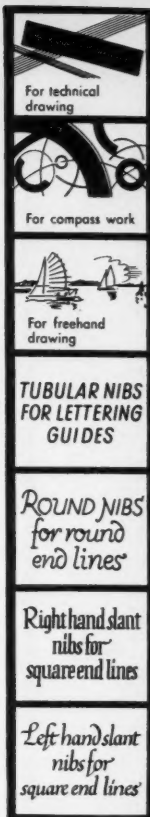
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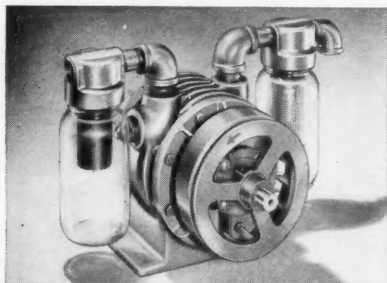
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Four carbon vanes lubricate themselves. Ball bearings are grease-sealed for life and separated from pump chamber by a ventilated space. Built in 7 models.

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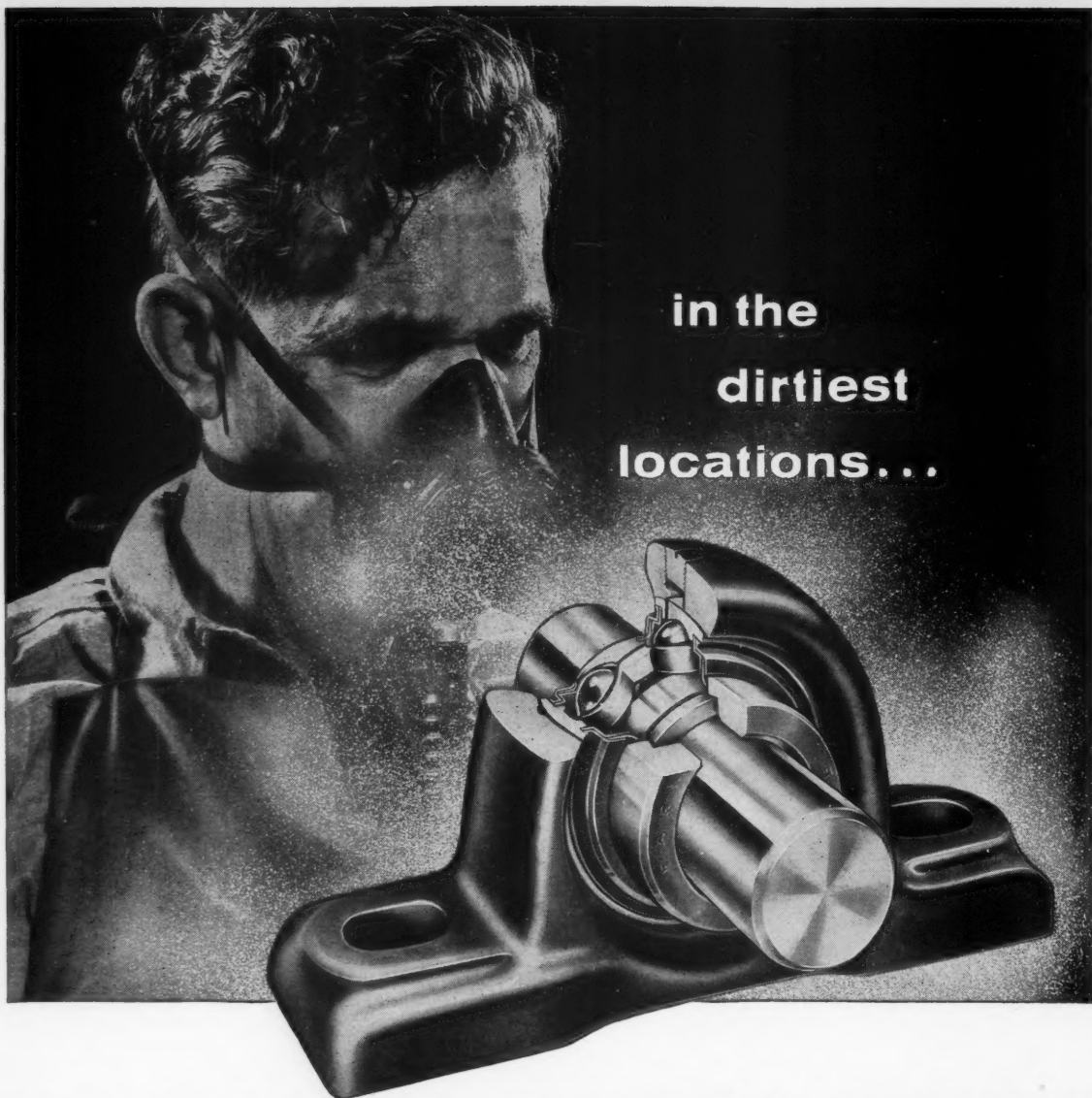
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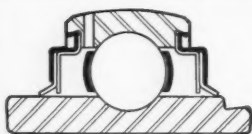
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shown in this cross-section consists of a synthetic, rubber impregnated, sealing washer, sandwiched between two "dished" steel plates. Outside pressure from contaminants increases the seal's effectiveness as the flared lip tightens against its contact surface and against the innermost supporting plate.

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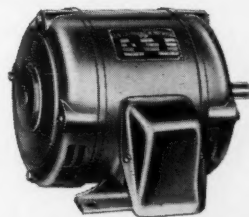
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## New products

continued

### Cylinders and controls

The complete **Carter Controls, Inc.** catalogue includes full and detailed specifications, ordering information, parts lists and prices on the whole line. It is easy to file and use as a working tool and every engineer should have his own personal copy. (227)

### Hydraulic packings

An illustrated 4-page folder is now available describing **E. F. Houghton & Co.** fabricated V-type rubber hydraulic packings.

The folder lists the number of leather, homogeneous rubber and fabricated rubber V's that should be used under various operating pressures, and outlines the use of male and female adapters with V sets. A complete listing of all Houghton standard Vix-Syn sizes is included. (228)

### Servo valve

A new dry-coil, two-stage electro-hydraulic servo valve (claimed to be 20% lighter and more compact than other servo valves of similar capacity) has been an-

nounced by **Vickers Incorporated**. The valve was designed primarily for aircraft and missile applications requiring hydraulic flow proportional to small electrical input signals.

High performance, low weight and small envelope make the new valve extremely desirable for porting modulated flow to an actuator in a flight control system or to a hydraulic motor for modulated rotary output motion with respect to input current. (229)

### Remote control

A self-contained, completely hydraulic, manual, remote control system (manufactured by **The Hydronic Company**) now incorporates an integral filler-bleeder fitting that eliminates the need for accessory pressure equipment. The time required to fill the system with oil (and bleed it of air) is greatly reduced. Both operations can now be accomplished simply and cleanly by leading two lines from the fitting directly to the fluid supply and using the master control lever as a pump.

A simple adjustment of equalizer valves permits relative positioning of master and slave levers when filling and bleeding have been completed. Levers maintain absolute relationship after ad-

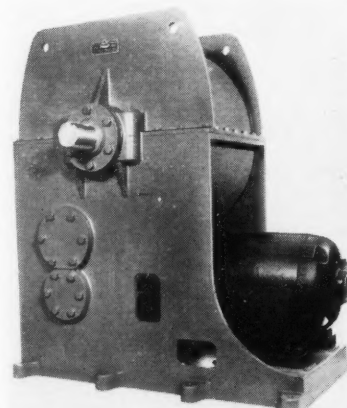
justment. Compensation in the master unit permits automatic expansion and contraction of fluid due to temperature variations.

The system provides smooth, positive remote control of valves, clutches, transmissions, throttles, governors, conveyor gates and similar devices. (230)

### Stainless sheet

In applications where Type 430 stainless satisfies heat or corrosion resistance requirements, many users of stainless steel sheet specify one of the 18-8 compositions which, although more costly than 430, are easier to fabricate. When 430 is bent sharply cracks sometimes form. After welding 430, embrittlement near the welded areas can be extremely troublesome. In elevated temperature service embrittlement may also be encountered.

Stainless sheet (recently developed by **Chromalloy Corporation**) can replace 430 in a number of cases. Its cost is considerably less than Type 430. (231)



### Right-angle drive

Designed and developed for driving all kinds of heavy rotating machinery at low and medium speeds, both parallel shaft and right-angle type speed reducers are being offered by **H. W. North Co.** for severe service applications in AGMA rating up to 1,500 hp. These new uni-centric drives are available in single and multiple reduction models representing a wide range of standard ratios and output speeds. According to the manufacturer, these drive units have greater capacity for space occupied than almost any other type of commercial speed reducer. High operating efficiency is said to be assured through the use of precision-cut, helical gears which are straddle mounted between heavy-duty roller bearings on large diameter alloy steel shafts.

All the right-angle type drives are constructed with an in-built motor base to conserve space and to minimize installation costs. (232)

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Plenty! That is, if the material you handle, like chow mein, will go through a pipe. If it will, the amazing Moyno Pump is just what you're looking for!

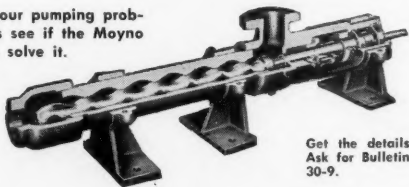
This pump is different . . . it is new, yet it is thoroughly service-proven for liquids, pastes, solids in suspension, abrasive-laden slurries, and a long list of other applications.

Perhaps, like the chow mein producer, you need to handle materials smoothly, without squeezing. The answer is progressive cavities—found only in the Moyno.

If your materials moving costs seem high—if you have a pumping problem—or if you're wondering whether the Moyno is adaptable to your product, write us today! Ask for a free copy of Bulletin 30-9.

By the way, with reference to the chow mein application, ladling proved to be too slow and expensive. Ordinary pumps made soup out of the celery. Moynos work perfectly, cost  $\frac{1}{3}$  less!

Tell us your pumping problem; let's see if the Moyno can help solve it.



Get the details Ask for Bulletin 30-9.

**Positive Displacement** — Moynos are available to pull up to a 29 vacuum while discharging under pressure. Big Moynos deliver up to 250 gpm. Pressures to 600 psi obtainable.

**Gentle** — no churning; won't break up semi-solids; won't aerate liquids.

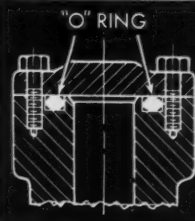
**Reversible** — pumps with equal efficiency in either direction.

**Trouble-Free** — self priming; won't cavitate or vapor-lock. Just one moving part — no valves to stick, no pistons to gum up. Built for tough service. Easy to maintain.

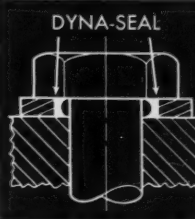
**Versatile** — adaptable to washers, drink dispensers, gasoline pumps, oil burners, etc. Can be custom-designed to meet your requirements.

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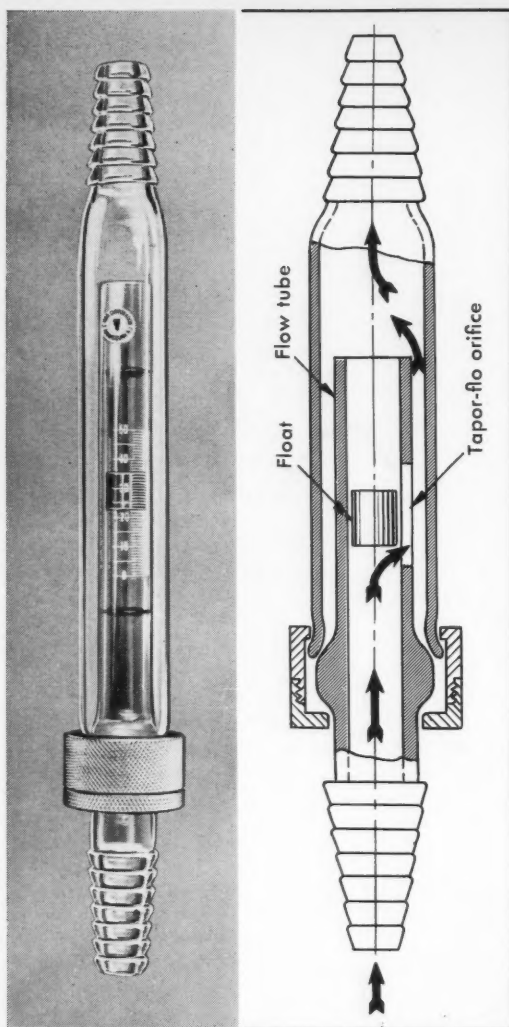
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The laboratory-type glass flow meter is for pressures up to 80 psi. Float is positioned in a precision bore Pyrex tube. The arrows indicate the flow of the fluid.

## A flow meter that can boast of its stability

**An instrument designed primarily for research and bench-scale work**

A new type of flow meter (developed by C-Mar Corporation for measuring low flow rates) provides new standards of float stability under fluctuating line pressures.

Known as the MB Series Tapor-Flo meter, this all-glass, variable-area flow indicator is designed primarily for use in research laboratories, pilot plants and bench-scale operations. An important feature is its outstanding stability, which results from the Tapor-Flo principle. The float lines out quickly without bobbing, and thus permits exact reading of the flow value without visual averaging. Easy installation, maintenance and range change are other important advantages.

As the flow rate increases (or decreases) a superfine-finished float rises (or falls) in a precision-bore glass tube, proportionately exposing more (or less) of a V-shaped orifice. Because this orifice is precisely shaped by ultrasonic impact grinding, the float height is always directly proportional to the flow rate. The flow value is therefore indicated on an evenly graduated scale that is etched into the side of the flow tube. Conversion factors (in table or chart form) can be used to translate scale readings into flow rate units. Alternatively, laboratory technicians can, in many cases, work directly from indicated scale values without conversion.

Maintenance is simple and inexpensive due to the inherent simplicity of the design. Only one threaded fitting need be removed completely to dismantle the instrument for periodic cleaning or for meter range change (by replacing the float).

The flow range depends on the specific gravity of the fluid, the size of the flow tube and the weight of the float. Ranges of the two standard-size Tapor-Flo indicators are shown in Table 1. For other capacities and fluids, interchangeable floats of various materials are supplied. An aluminum float, for very low flows, can be anodized black or white for readability. ★

**Ranges of Tapor-Flo indicators**

(Based on water at 60F)

Flow range	Flow units	Flow tube size	
		¼ in.	½ in.
Minimum	gpm	0.013 to 0.13	0.058 to 0.51
	litre/min	0.05 to 0.50	0.22 to 1.96
Maximum	gpm	0.091 to 0.90	0.36 to 3.52
	litre/min	0.35 to 3.4	1.35 to 13.4

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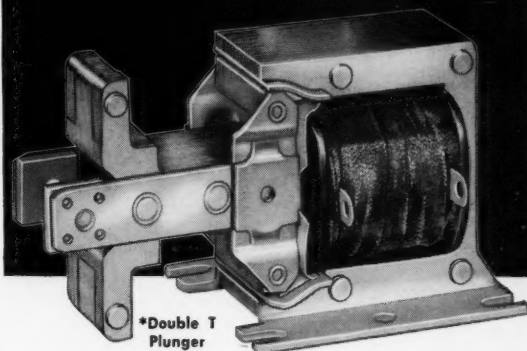
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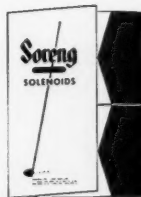


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## Letters

### Adhesive

In Your January 1958 edition on page 33 you have an article entitled "Wonder Adhesive From a Routine Test." In reading we note that the adhesive was developed at the Research Laboratories of the Eastman Kodak Co. and our purpose in writing you at this time is to endeavor to locate a source whereby we might procure this material here in Canada. If there is no such source in Canada we were wondering if you could give us the names of the companies so that we could be able to write directly to them in order to obtain information regarding this product.

from J. Lyle, Purchasing Agent, The P. B. Yates Machine Company Ltd., Hamilton, Ont.

### Tapered orifice valve

We would like to obtain additional information on the valve with tapered orifice shown on page 54 of the January 1958 issue of Design Engineering. Would you let us have the address of the manufacturer, General American Valve Co., or better still, enclose this letter in an envelope addressed to them.

from N. A. Burke, Plant Engineer, Canadian International Paper Company, Temiskaming, Que.

### Silver plating

In the October 1957 edition of your magazine you mention a paper published by Sel-Rex Corporation describing their new bright silver plating process.

We are interested in obtaining information about this process. Would it be possible for you to contact these people and inform them of our interest. Or, if you prefer, please send us the address of their company and we will write them direct.

from Geo. E. Beavers, President, Beavers Dental Products Ltd., Morrisburg, Ont.

### Soldering aluminum

Please send more information and details on soldering aluminum (article No. 216) in your January 1958 edition.

from F. Lloyd Young, Production Manager, Dominion Bronze & Iron Limited, Winnipeg 3, Man.

### Photo stress

Referring to the article "A complete color picture of strain distribution at a glance" (225) of your May 1957 issue, I would like to ask you where more information on this new photoelastic method for experimental stress analysis is

available, and whether there are any companies, who produce the photoelastic plastic commercially.

Being a student of mechanical engineering, I want to use this information for my thesis, and therefore, appreciate if you could answer me as soon as possible.

from Nils Hanssmann, 80 Grosvenor Ave. S., Hamilton, Ont.

(We advised him to contact Tatnall Measuring Systems Co., The Budd Company, 2450 Hunting Park Ave., Philadelphia 32, Pa.—Ed.)

### Brainstorming

Re your editorial on page 70, "Brainstorming Develops Creativity" of the August 1957 edition of Design Engineering, reference is made to a textbook "Applied Imagination" by Alex F. Osborn.

We are interested in obtaining a copy of this textbook. Could you supply us with the publisher's address or a book store where we could purchase a copy. Any information which you could give us re the above will be appreciated.

Will you please address your reply c/o the Engineering Department.

from W. E. Robinson, Chief Engineer, Bristol Aircraft (Western) Ltd., Stevenage Field, P.O. Box 874, Winnipeg.

(We supplied the address: Chas Scribner & Sons, 597 Fifth Avenue, New York—Ed.)

## No time like the present

LOTS OF YOU ENGINEERS have the nucleus of an article tucked away in a drawer somewhere, either in the form of rough notes or as a rough typescript.

The reason, of course, that you haven't done anything about it is because you probably feel that nobody will be interested in publishing it—so why do all the work necessary to get it in shape for nothing?

There is somebody interested in your technical article: DESIGN ENGINEERING is always on the lookout for suitable contributions. Not that we are short of material, mind you. But it does seem a pity that good stuff should not see the light of day.

Why not act at once and tidy up that article, get it typed and submit it to DESIGN ENGINEERING? If we like it enough to publish it, you will be paid. Not a fortune, perhaps, but enough to make it worth your while.

And think of the personal satisfaction of seeing yourself in print.



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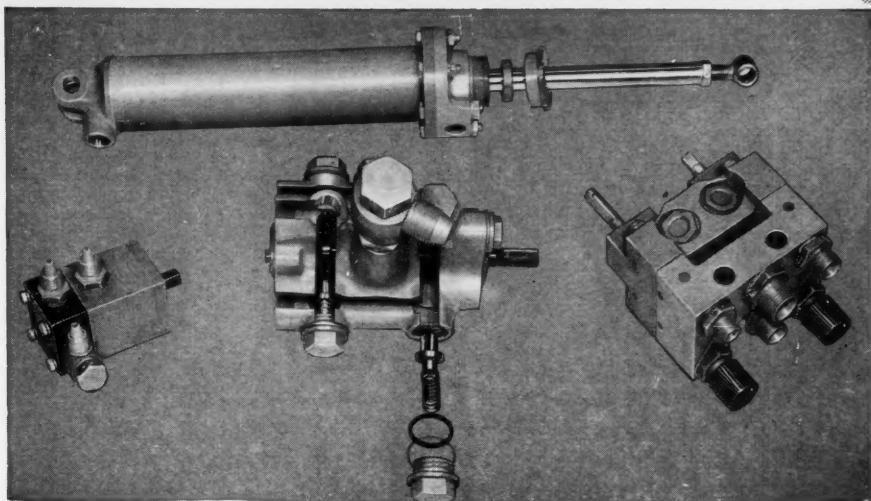
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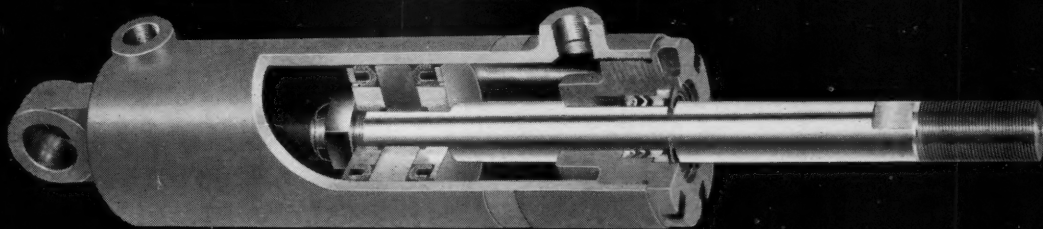


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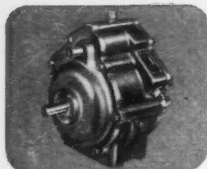
This manual will save you hours of time in specifying cylinders. Many dimensioned basic designs for general and special purpose double-acting cylinders.



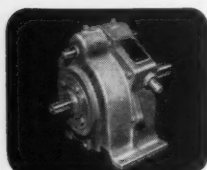
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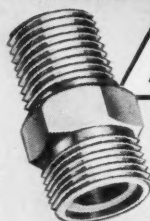
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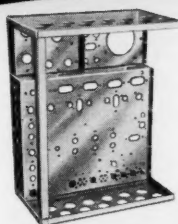
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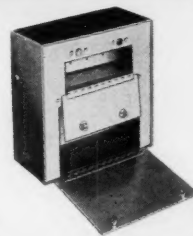
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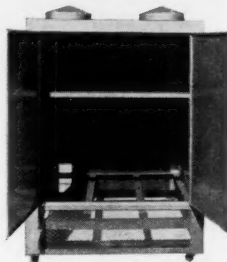
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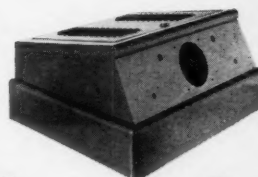
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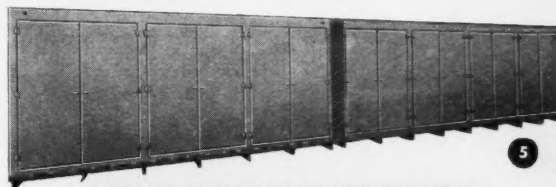
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## Editorial

### Short cut to DE Show information

Engineers who want more information about the exhibits at this year's Design Engineering Show (Chicago, April 14-17) will not have to go through the tiresome process at each booth of filling in a card and popping it in a box.

Plastic plates (similar to the ones used for charge accounts at departmental stores and service stations) will be distributed at the Show. Each of these plates will carry the visitor's name, address, title and company. Booths will be equipped with machines to register the name of anyone requiring literature or other information.

The exhibitors, too, will benefit, for it will do away with the problem of cards that are illegible or only half-completed.

#### At the Conference:

Methods for achieving a better exchange of information between engineers will be one of the topics to be discussed at the four-day conference to be held concurrently with this Show. The conference is sponsored by the Machine Design Division of the ASME.

Included will be two papers on the exchange of engineering information: "The information centre of tomorrow" and "A central catalogue file saves engineering time and money."

Other items that we think will interest design engineers are: Uncommon engineering metals; Compatability of metals in bearing contact; and High strength structural sandwich-construction.

#### Thorium-magnesium alloy:

There was one particularly interesting item in the Annual Review of Uranium (Easson & Co. Ltd.), to the effect that Dow Chemical Co. of Canada (Dow is the world's largest producer of magnesium) and Rio Tinto Mining Co. of Canada (who have access to the largest available source of thorium on the North American Continent) have formed a new company, the object of which could well be the production of a thorium-magnesium alloy.

It is reported that such an alloy surpasses any other known to the Western World in its resistance to the increasingly high temperatures required in modern engines, reactors, rockets and missiles.

#### Management conference:

In recognition of the engineer's growing role in management, the ASME and the AIEE are holding a joint engineering management conference in Boston.

All those registering in advance will receive a specially prepared visitations booklet, containing background material and questions, the purpose of which is to stimulate thinking before the conference, in order to provide more lively and informative sessions. Anything that does this is certainly a good idea.

*William Morse.*

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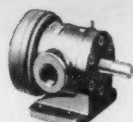
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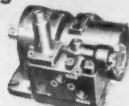
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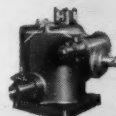
Vane Pump



Two Stage Vane Pump (2000 psi)

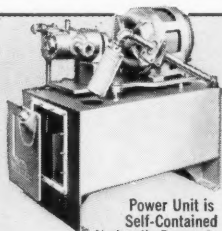


Double and Two-Pressure Vane Pumps



Variable Delivery Piston Type Pump

## PUMPS



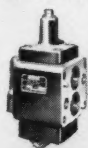
Power Unit is Self-Contained Hydraulic Power Source



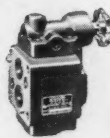
Balanced Piston Type Relief Valve



Hydrocushion Type Sequence Valve



Hydrocushion Type Counterbalance Valve



Pressure Reducing Valve



Flow Control Valve with Hydrostatic Compensator

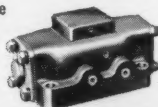
## PRESSURE CONTROLS



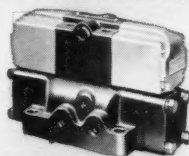
Rotary Type Four-Way Valve



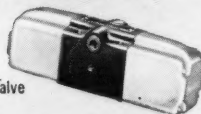
Plunger Type Four-Way Valve



Pilot Operated Four-Way Valve



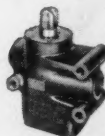
Solenoid Controlled Pilot Operated Four-Way Valve



Solenoid Operated Four-Way Valve



Check Valve

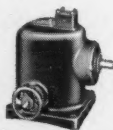


Deceleration Valve

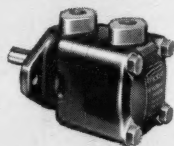
## DIRECTIONAL CONTROLS



Constant Displacement Piston Type Motor



Variable Displacement Piston Type Motor



Balanced Vane Type Motor

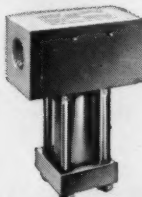


Hydraulic Cylinders

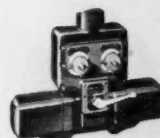
## MOTORS



Accumulators

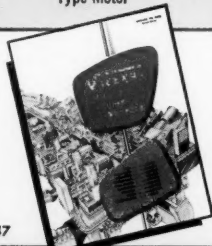


High Pressure Type Micronic Oil Filters



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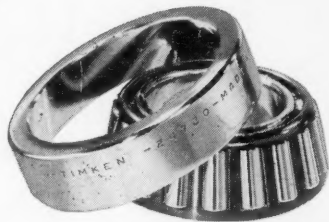
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